TH ANNUAL QUALITY CONTROL FEATURE ISSUE

MAY, 1950

TOOLING and PRODUCTION

The Magazine of Manufacturing Management

How to slash inspection costs and reduce scrap!

COMPLETE EDITORIAL INDEX . . page 70 NEW PRODUCTS . . page 194 HELPFUL LITERATURE . . pps 142 and 192

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The Magazine of Manufacturing Management

formerly Tool-Die-Machine PROGRESS 1934-1941
TOOL & DIE JOURNAL 1941-1951

George J. Huebner, Founder

VOL. XXII—No. 2 MAY, 1956

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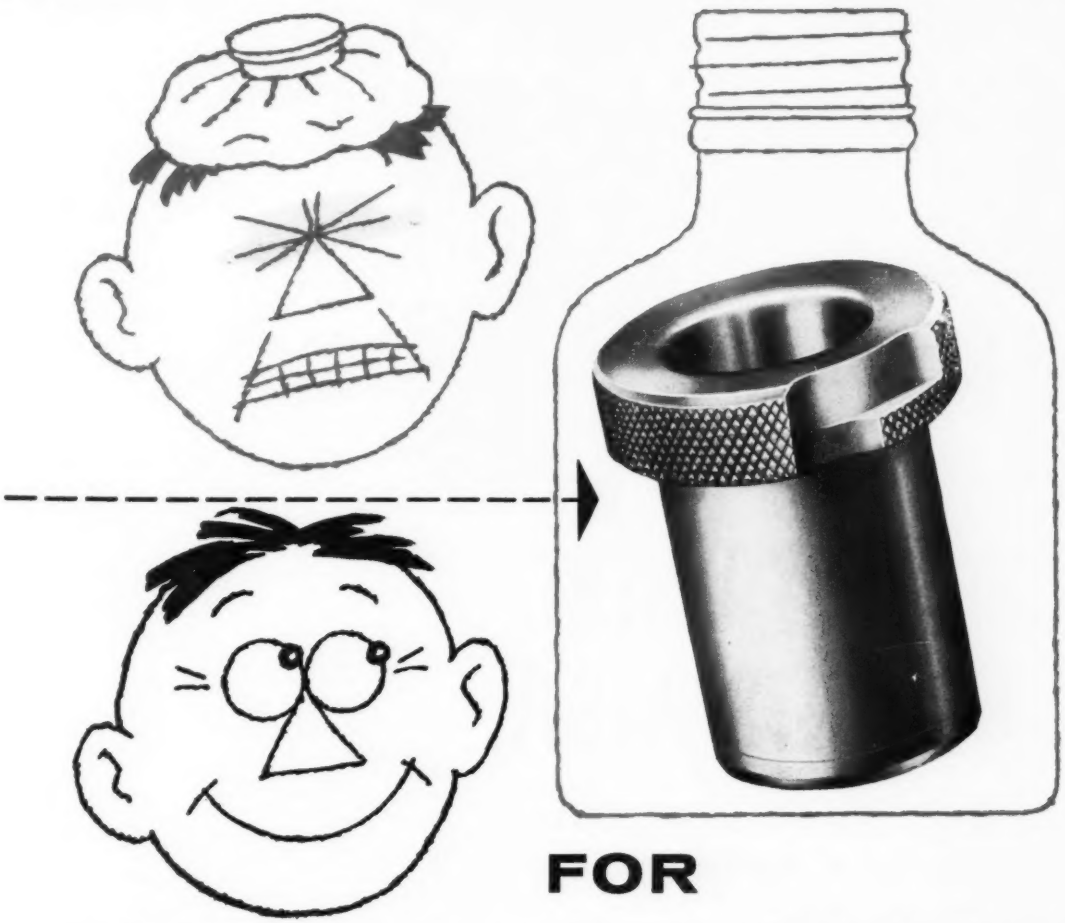

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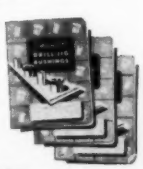

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Talk of the Month

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QUALITY CONTROL AND STANDARDIZATION

by John J. Riordan
Acting Staff Director for
Inspection and Quality Control
DEPARTMENT OF DEFENSE
Washington, D. C.

IN BROADEST PERSPECTIVE, there are two areas in which government and Industry are making Quality Control an effective instrument for standardization.

The first area encompasses the field of product quality and relates to the method by which consumers and vendors jointly delineate what constitutes acceptable quality. Substantial progress has been made in improving techniques for defining product quality acceptability. This progress, however, has been limited largely to common commodities and to items of a highly stable design.

There are numerous products, particularly heavy equipment, for which it is practically impossible to define exactly what constitutes acceptability. This is especially true of products whose reliability and life characteristics are of paramount importance. Frequently, such characteristics cannot be adequately tested except by test to destruction. Therefore, both consumers and vendors recognize the fact that the best assurance of the quality of a product is assurance that it was made right in the first place.

The manner in which an item is fabricated ultimately reflects a multiplicity of influences, including design, management attitudes, employee skills, tools, production engineering, etc. However, consumers, particularly the government, are gradually coming to recognize that it is possible to define what constitutes the basic elements of a satisfactory arrangement to assure that a product conforms to specifications and drawings. This "satisfactory arrangement"

Adapted from an address delivered by Mr. Riordan at the Sixth National Conference on Standards, in Washington, sponsored by the American Standards Association and the National Bureau of Standards.

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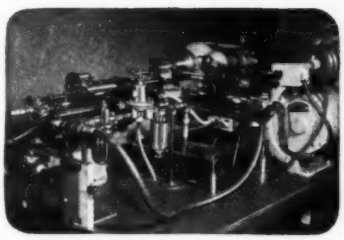
...because you think it's too complicated and expensive?



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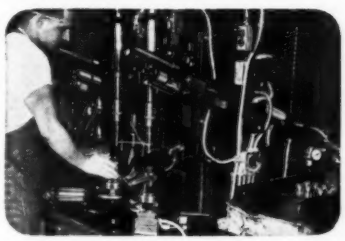

Here's a case where Fluid Power control enables one operator to turn out the work of four. He services two units like the one shown. The operation is a critical reaming job on the six chambers of a revolver cylinder.

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CIRCLE INFORM-A-GRAM KEY NO. 8

constitutes, essentially, a satisfactory Quality Control system. The second area of Quality Control which provides substantial opportunity for government and industry to promote standardization is in the defining of the prime essentials of a satisfactory Quality Control system.

What is the Department of Defense doing to standardize requirements for both product quality and Quality Control systems?

Techniques for Defining Product Quality

With respect to product quality, consumers and vendors frequently are forced to ask themselves this basic question: What is a "good" product? The word "good" is, in itself, almost meaningless. The Department of Defense has exerted great influence in developing techniques which make it possible to answer a question such as this in objective and scientific terms. Three basic techniques have been developed for defining quality. For the sake of convenience, these techniques may be identified as those related to (1) engineering analysis; (2) statistical analysis; and (3) instrumentation.

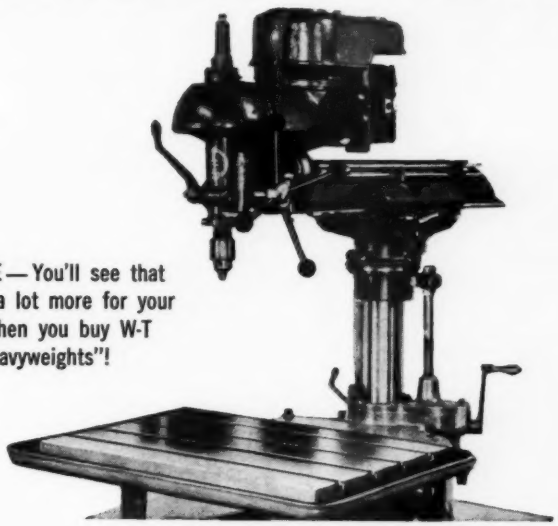
Before we proceed, it is well to keep in mind that the very existence of these techniques poses a basic issue of policy with respect to the consumer-vendor relationships. This is the question as to whether consumers should demand that the products they buy conform "100%" to quality requirements. Of course, 100% conformance is almost an impossibility. But let's use the term to indicate the maximum conformance that is practical. As you know, some industries have already accepted the concept that quality need not be 100% — that something less can be accepted to the complete satisfaction of both the consumer and the vendor.

Now, back to this basic issue of what is a "good" product. In general, a "good" product is one that conforms to definitive acceptance inspection requirements. To be meaningful, these requirements must be stated in terms of (1) the specific quality characteristics to be tested or inspected; (2) the instrumentation by which these inspections are to be made; and (3) the risks that are to be taken when more than one unit of a product is involved in the decision of acceptability. Obviously, if you are dealing with only one unit, the lot quality problem does not exist. Ordinarily, however, lot quality and unit quality are of equal importance, and both must be considered in planning the decision-making program by which products are to be accepted.

Engineering Analysis

The "building blocks" of a sound quality evaluation program are the quality characteristics which collec-

WALKER-TURNER



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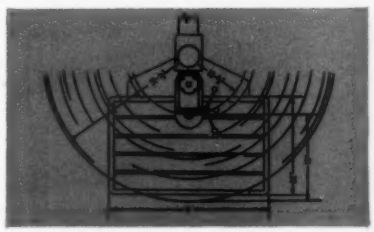

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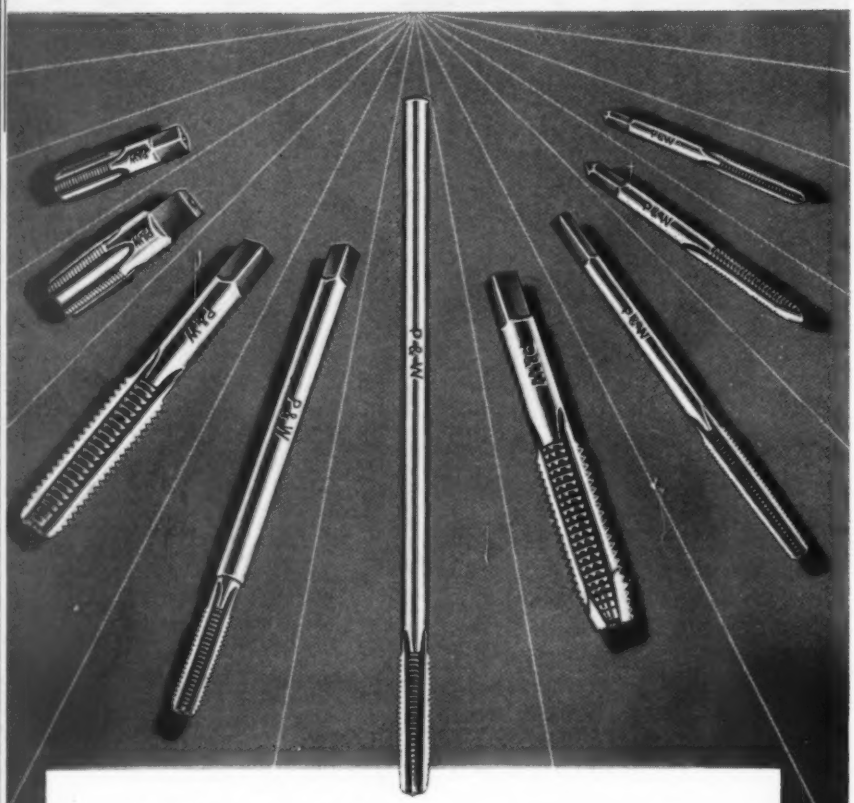

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tively describe the product. These must be stated explicitly and precisely.

Despite the simplicity and obviousness of this idea, it is, for some unknown reason, a stumbling block to production and management personnel. There is a tendency to want to speak in very generic, non-scientific terms. The Department of Defense has made real progress in developing a rationale and methodology for analyzing products, so that the specific quality characteristics pertinent to the decision of acceptability are stated clearly in various documents — in some instances, in specifications. Sometimes the identification of these quality characteristics takes the form of a document called the Classification of Defects. A challenging opportunity exists for government and industry to develop further both the techniques and content of Classifications of Defects.

Statistical Analysis

As mentioned before, if you are concerned with more than single unit of production, you immediately face the problem of whether to inspect every unit or only some of them. This is a statistical problem. Fortunately, mathematical statistics provides both consumers and vendors with an objective solution of the problem of choosing sampling plans with known risks. Military Standard 105A, developed by the Department of Defense, serves this purpose ideally for inspection by attributes. The Department is presently working on a similar standard for inspection by variables.

Instrumentation

I have hardly touched upon the problem of instrumentation, and I must acknowledge that in this area there is need for standardizing gaging and other measurement requirements for Quality Control purposes.

It is true that we have wonderfully precise instruments for measurements of all kinds. But, for many items, we still find consumers and vendors at odds because of differences in gaging and in instrumentation.

During World War II, some of the military departments attempted to tie in, in one package, the Classification of Defects, sampling requirements, and the instrumentation. This was done by identifying, by number, the specific gage or other instrument to be used to measure or test any particular quality characteristics. Although this approach has been largely abandoned, it would seem that, at the present time, it would be to the advantage of both consumers and vendors to reconsider this approach for common-type items. It is impractical, however, for equipment that is constantly undergoing redesign.

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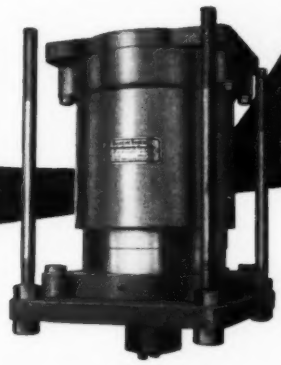

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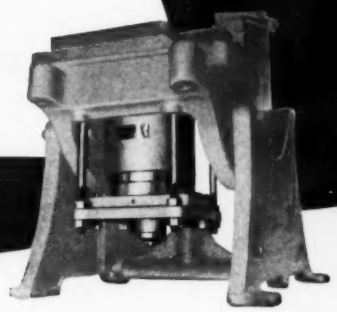

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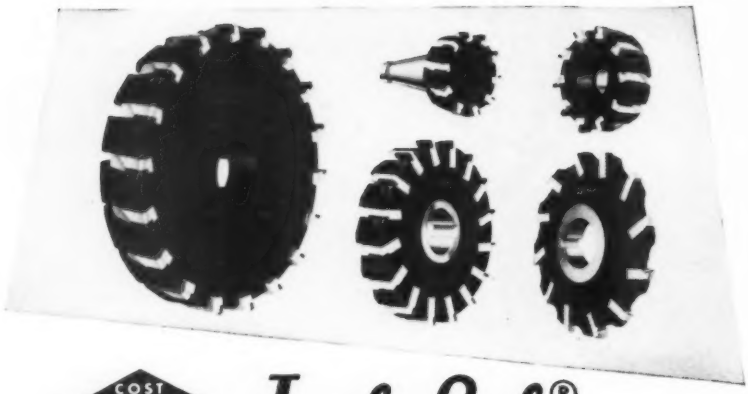

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CIRCLE INFORM-A-GRAM KEY NO. 12

An Acceptable Q-C System

The second broad area of standardization in Quality Control concerns the problem of defining what constitutes an acceptable Quality Control system. There are numerous items such as aircraft engines, guided missiles, and fire control equipment, all of which are of a highly complex and changing design, for which it is frequently impractical to establish detailed inspection requirements.

I am not overlooking the fact that it is possible to establish certain performance requirements, but even performance tests, as conducted in the laboratory, frequently fall far short of providing assurance of performance reliability. It is of prime importance that such products be manufactured under a satisfactory Quality Control system. But, what constitutes a satisfactory Quality Control system? This question has two facets.

The first relates to the nature of the Quality Control system itself and the second to the methods used to determine whether or not the system is satisfactory. I should like to interpose, here, that the purpose of a Quality Control system is not only to assure quality but also to achieve quality as economically as possible by eliminating duplication.

Progress in Standardization

With respect to the nature of the system itself, the military departments, particularly the Air Force, have made considerable progress. MIL-Q-5923, originally prepared by the Air Force, is the first document that has attempted to identify the essential elements of a satisfactory Quality Control system. Whatever its faults or virtues, the specification itself represents a major step forward in the field of standardizing Quality Control requirements.

Progress is also being made in standardizing procedures by which contractors' Quality Control systems are evaluated. In this connection, I should like to mention the accomplishments of the Signal Corps in developing its plan called The Reduced Inspection Quality Assurance Program (RIQAP). This plan achieves the objectives of eliminating duplication between government and industry and, at the same time, makes it possible for government and industry to attain an objective and intelligent understanding of what constitutes a satisfactory Quality Control system for certain products in which the Signal Corps has a prime interest.

The Navy Department has been doing development work in this same area and has recently published a guide for use by Navy inspectors in evaluating contractors' inspection systems. This guide goes a long way towards standardizing techniques by

. . . *Continued on Page 16*

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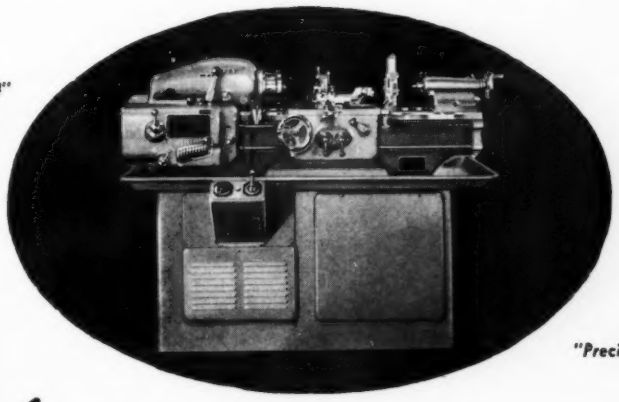

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. . . Talk of Month from Page 12

which inspectors make decisions as to whether or not a Quality Control system can be considered satisfactory.

The Air Force has a similar document called Air Materiel Command Manual 74-21.

The mere mention of these various developments indicates the active interest and aggressiveness of the Department of Defense in standardizing its inspection operations without in any way infringing upon the rights of vendors. In this connection, it is well to keep in mind that the problem of standardization in Quality Control is extremely complex because of the extensive variety of items with which the Department of Defense is concerned. For many of these various items, it is possible to standardize from product quality requirements; for others, it is necessary to concentrate attention on standardizing the requirements pertinent to manufacturing control, which must be satisfied to assure that the product will perform satisfactorily in service.

Why Standardization?

Before I close, it seems appropriate to ask this question: Why do we want to standardize Quality Control operations? We might also ask: Why government inspection?

There are actually three reasons for government inspection: protection, equitable treatment of vendors, and coordination of contractual matters between the government and contractor.

The nature of the first and last functions is quite apparent. The second purpose of inspection—equitable treatment of vendors — frequently escapes the attention of those who are critical of government inspection. Businessmen, for example, sometimes think of inspection as simply one more arm of the giant octopus called "government bureaucracy." It is sometimes forgotten that inspection serves to protect vendors as well as consumers. In the case of government procurement, "quality" vendors are protected from the unfair competition of marginal and "fly-by-night" operators. Equitable treatment includes protecting the right of all citizens to compete fairly for government contracts; it also includes government responsibility for assuring that vendors deliver both quality and quantity in accordance with the terms of the contract.

Now, to return to the first question: Why do we need standardization in Quality Control? The answer is to assure that government inspection is operated as economically as possible. Such economical operation is in the interest of both the govern-

. . . Continued on Page 32

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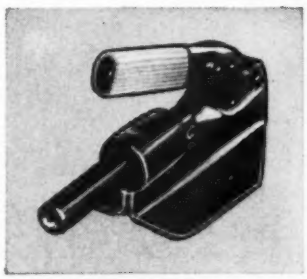

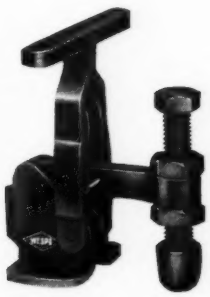

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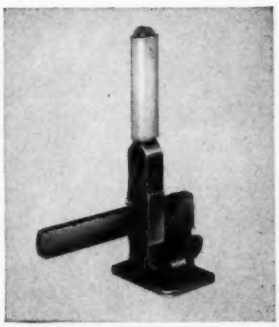

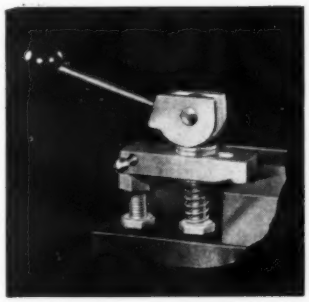

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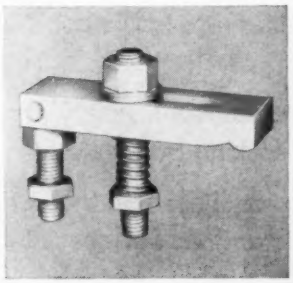

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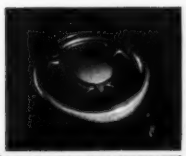

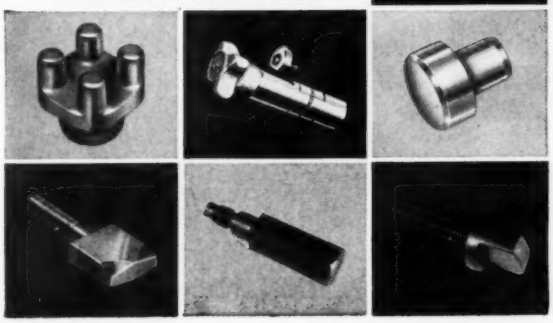

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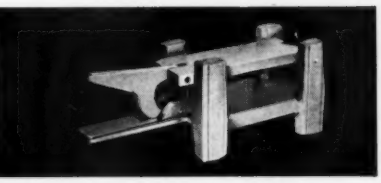

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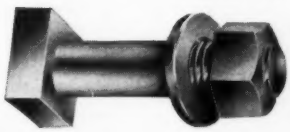

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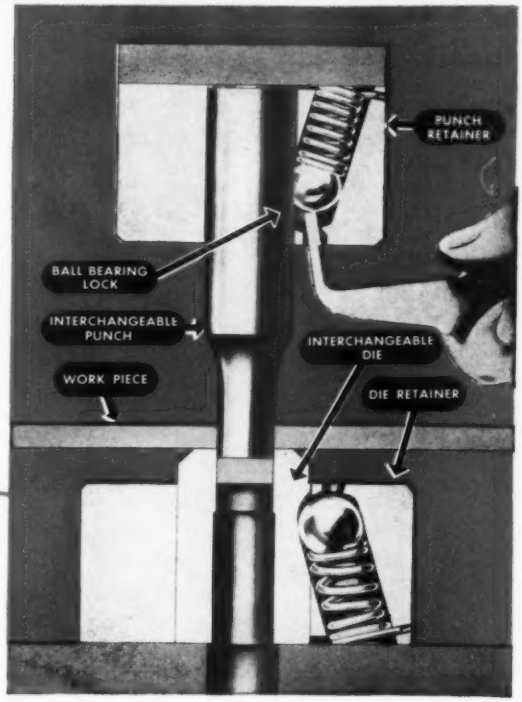

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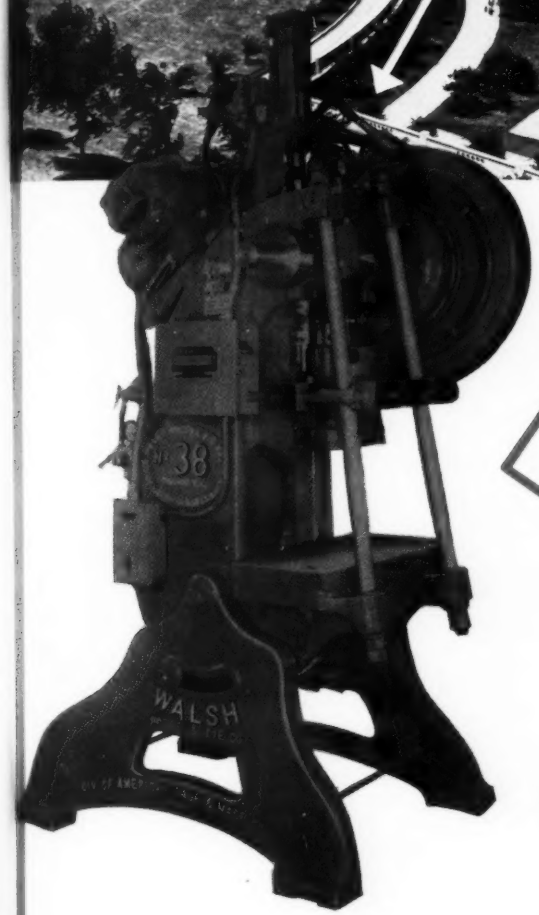

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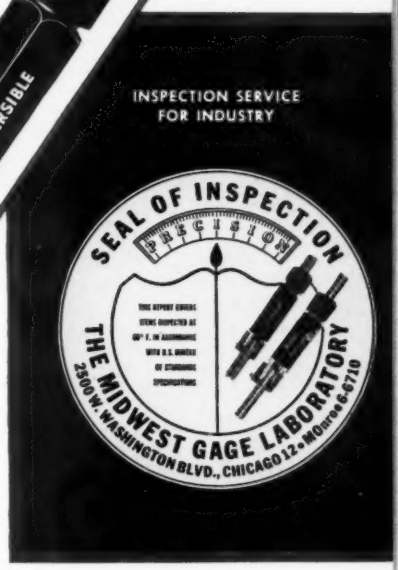

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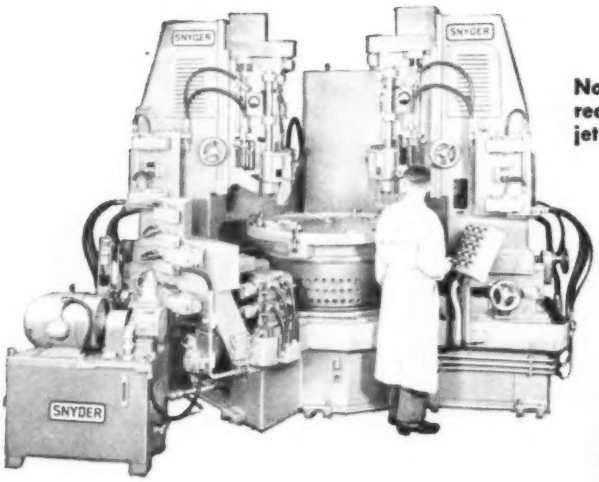

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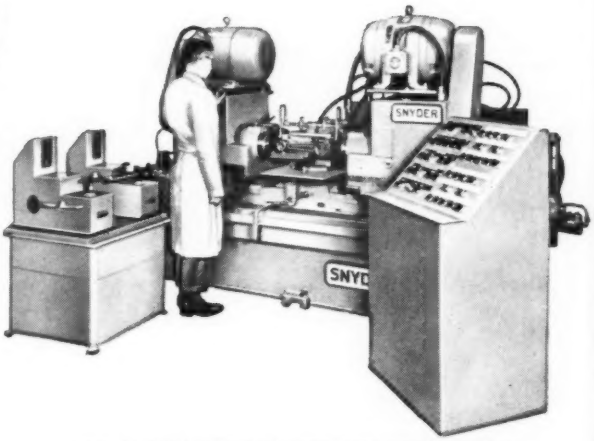

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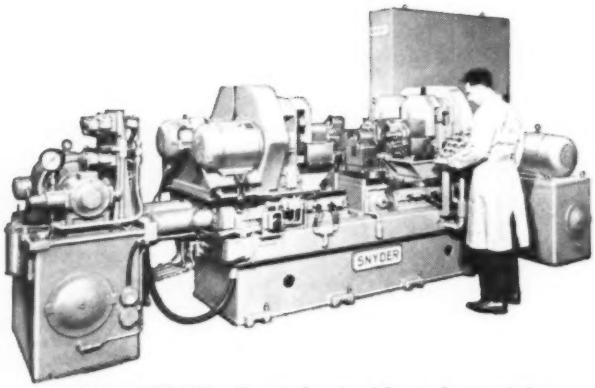

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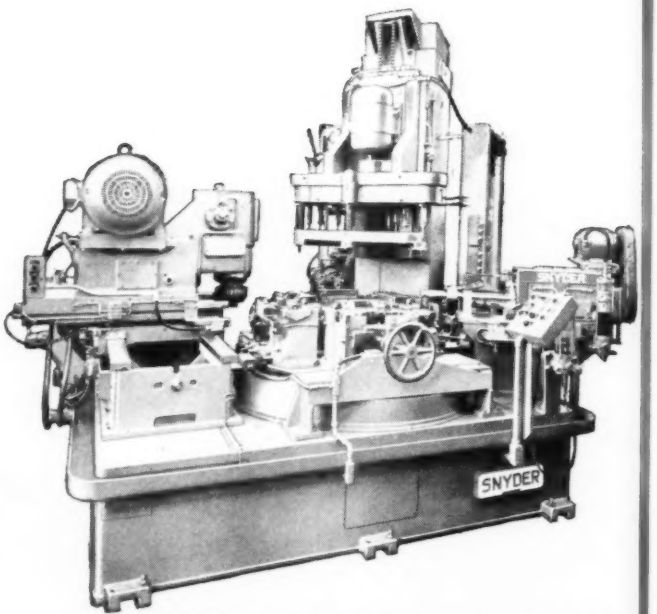

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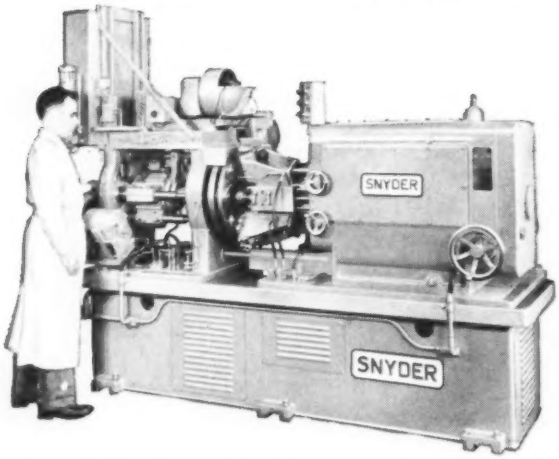

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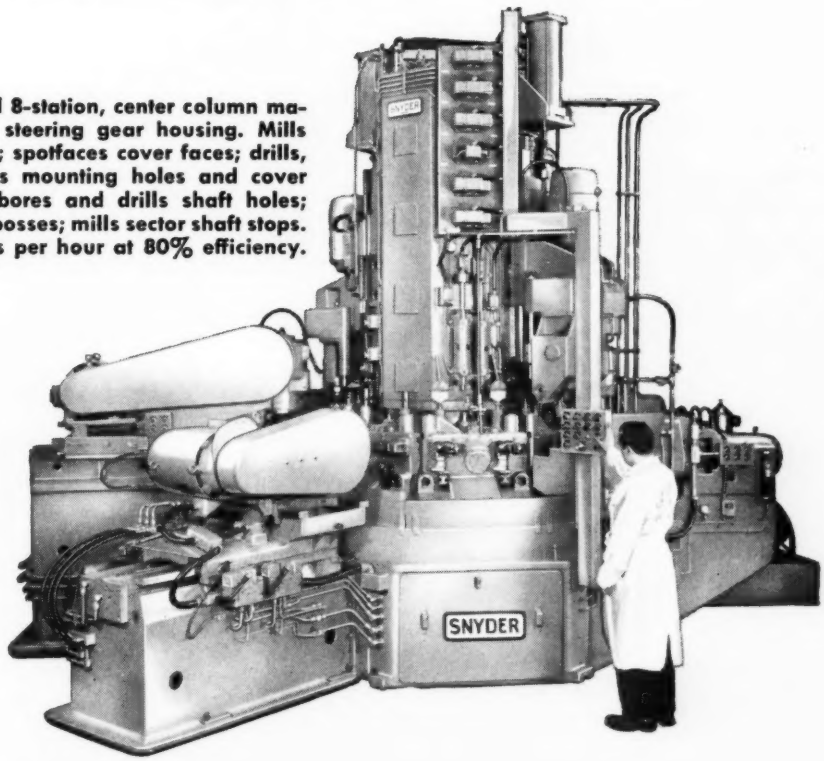

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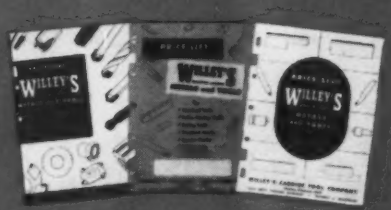

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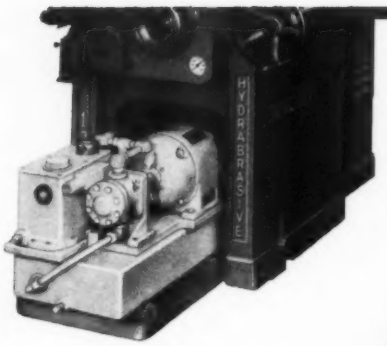

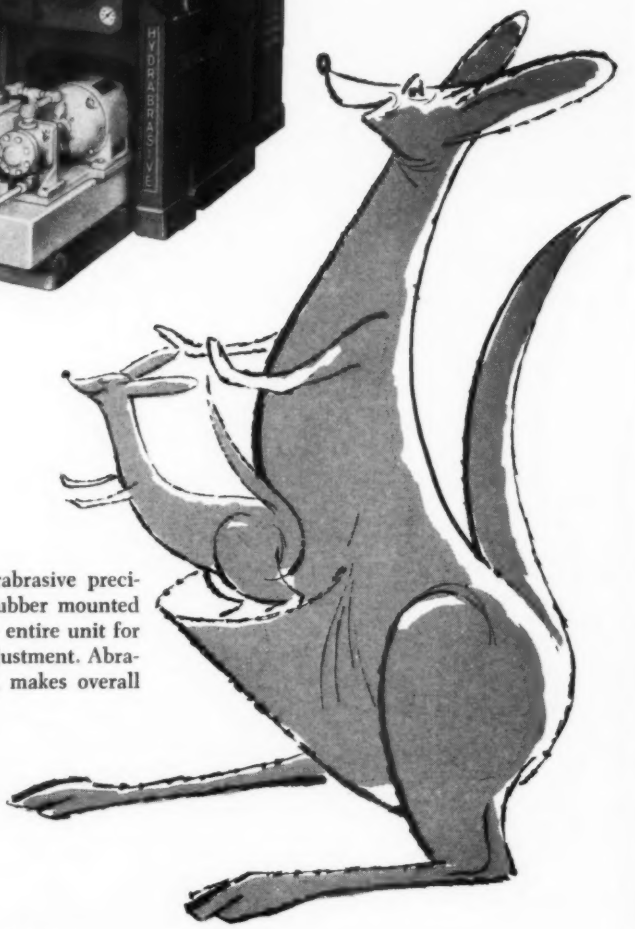

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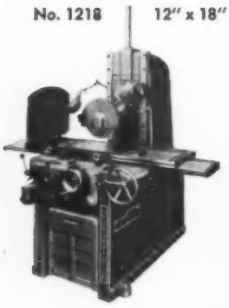

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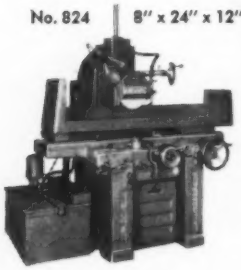

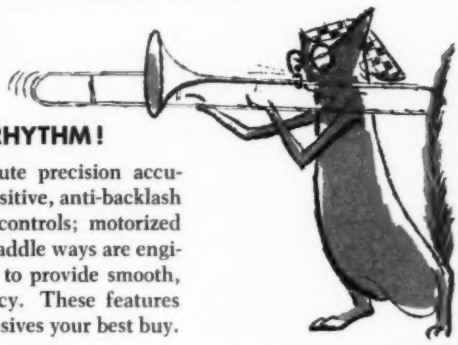

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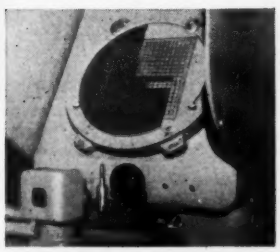

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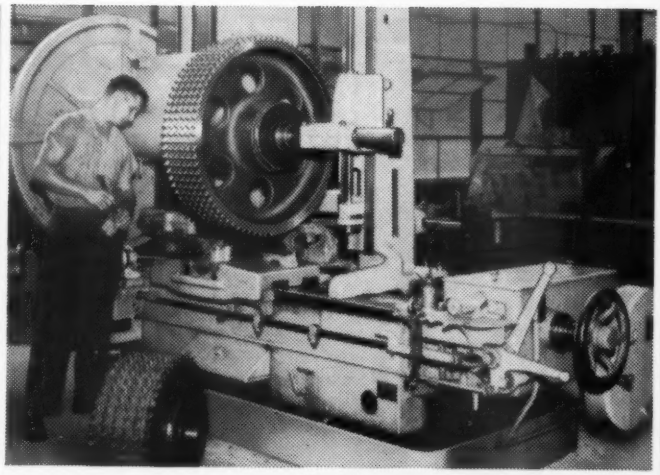
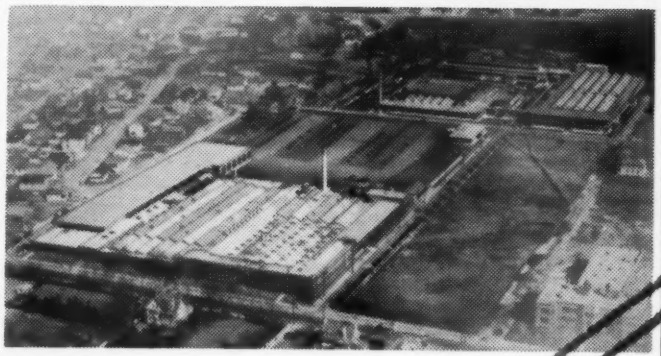
are now manufactured by POTTER & JOHNSTON COMPANY at the P&J plant, Pawtucket, Rhode Island

TO AVOID DELAYS AND TO INSURE PROMPT ATTENTION AND HANDLING, PLEASE ADDRESS ALL INQUIRIES AND ORDERS DIRECT TO POTTER & JOHNSTON AT PAWTUCKET.

As previously announced, assets of the Newark Gear Company have been acquired by Potter and Johnston Company, subsidiary of Pratt & Whitney Company, Incorporated. In addition to the complete line of P&J Automatic Chucking Turret Lathes, these long-famous automatic gear machines are now being manufactured in our Pawtucket, Rhode Island plant. Product literature, including complete specifications and engineering data, is available. Write on your Company letterhead outlining your requirements.





POTTER & JOHNSTON COMPANY

PAWTUCKET, RHODE ISLAND

SUBSIDIARY OF PRATT & WHITNEY COMPANY, INCORPORATED

AUTOMATIC CHUCKING TURRET LATHES

P&J CUTTERS NEWARK GEAR HOBBERS

NEWARK GEAR CUTTING MACHINES

P & W BRANCH OFFICES: Birmingham • Boston • Chicago • Cincinnati • Cleveland • Detroit • Los Angeles • New York • Philadelphia • Pittsburgh • Rochester San Francisco • St. Louis EXPORT DEPT: Pawtucket, Rhode Island AGENTS: Dallas, Southwest Industrial Sales Co. • Houston, Wessendorf, Nelms & Co.

CIRCLE INFORM-A-GRAM KEY NO. 26

"Home-made" Automatic Drill set-up cuts drilling cost from 2¢ to 1/10¢ per piece

Two standard Dumore Automatic Drill Units plus low-cost tooling boosts production for midwest die cast firm.

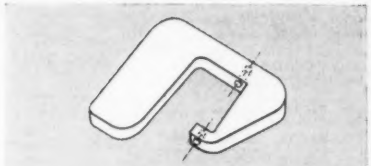
When Acme Die Casting Corp., Racine, Wisc., bid on a die cast zinc automobile door lock, their price hinged on maintaining high production rates on every phase of the operation. However, when hand drilling two opposed .160" holes, they found it impossible to hold the necessary .002" alignment tolerances as well as maintain the required high hourly production. They began looking for a solution.

Uses Dumore Advisory Service

Working closely with Dumore's Application Advisory Service, the company devised the special purpose machine pictured below. It consists of two Dumore Series 24 Automatic Drill Units designed into a completely automatic set-up that amounted to only a few hundred dollars in tooling and fixture costs. Complete synchronization of stroke, feed and drilling is made possible with effective use of micro-switches.

From 150 to 1500 pieces per hour

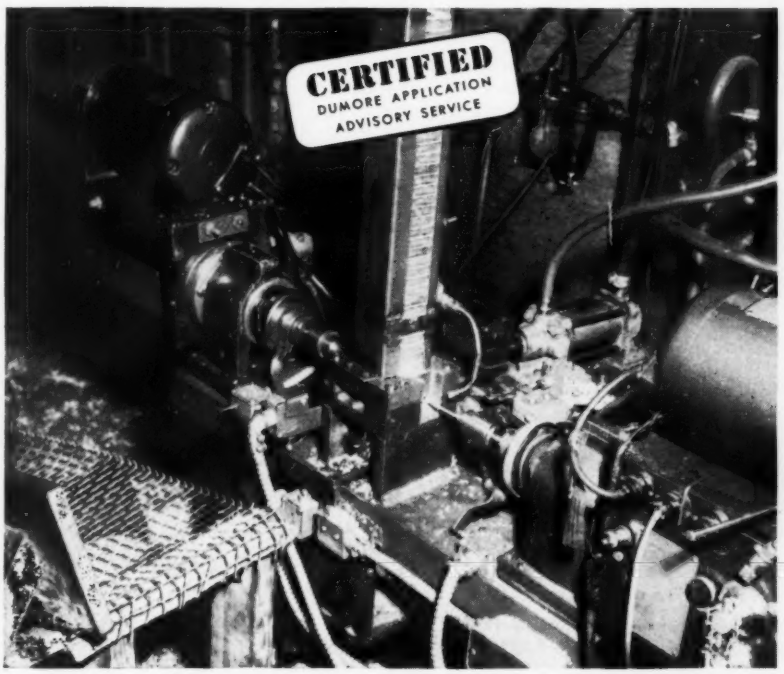
By increasing production from 150 to 1500 pieces per hour, drilling costs were reduced from 2c to 1/10c per piece. Operating at three shifts per day, the Dumore Units and tooling paid for themselves within a matter of weeks.

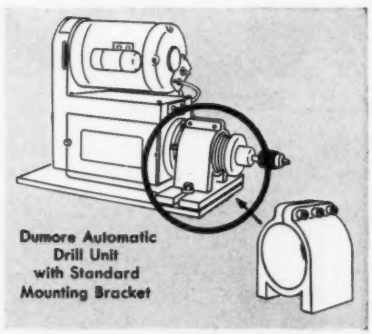


PART: Zinc Die Cast Automobile Door Lock.

OPERATION: Drill two opposed .160" holes, hold alignment within .002", parallelism .0015".

PRODUCTION: 1500 pieces per hour, or 25 per minute.





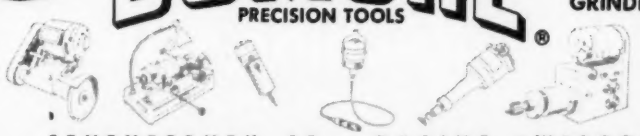
Dumore Automatic Drill Unit with Standard Mounting Bracket

QUICK REMOVAL and transfer of Dumore Units to other parts of the shop for drilling, tapping, reaming and other related operations is made possible with their unique nose mounting bracket. It quickly adapts Unit at any angle to existing shop equipment.

AN INEXPERIENCED OPERATOR loads the hopper while gravity feed forces the piece into the drilling fixture. The two opposed Dumore Automatic Drill Units advance simultaneously, drill, then retract to starting position—all automatically. The Dumore's built-in electrical and pneumatic controls permit almost unlimited set-up and production possibilities.

DUMORE PRECISION TOOLS

AUTOMATIC DRILL UNITS
TOOL POST AND HAND GRINDERS



SEVENTEENTH ST., RACINE, WISCONSIN

Let Dumore's Application Advisory Service help you get increased production and lower costs on jobs like this. Write for FREE Dumore Application Analysis Kit.

CIRCLE INFORM-A-GRAM KEY NO. 27

San Francisco • St. Louis **EXPORT DEPT:** Pawtucket, Rhode Island **AGENTS:** Dallas, Southwest Industrial Sales Co. • Houston, Wessendorf, Nelms & Co.

CIRCLE INFORM-A-GRAM KEY NO. 26

DIAMOND MACHINE TOOL COMPANY

PICO, CALIFORNIA

Send us your catalog, "Profit From Presses" at once.
No cost. No obligation.

NAME.....

COMPANY.....

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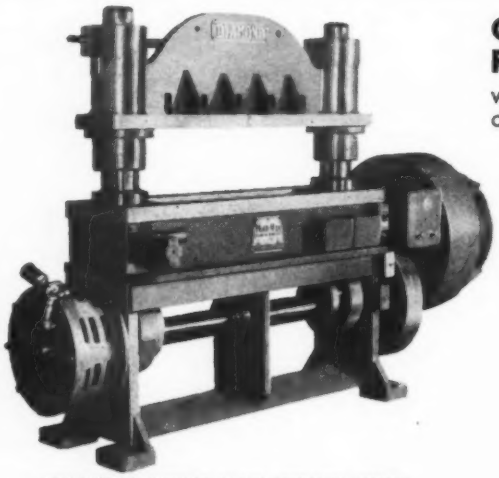
CITY.....STATE.....

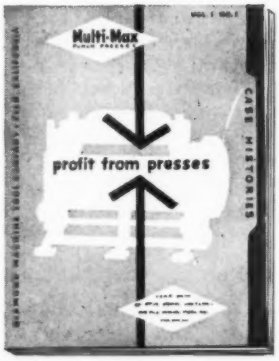
PROFITS from PRESSES



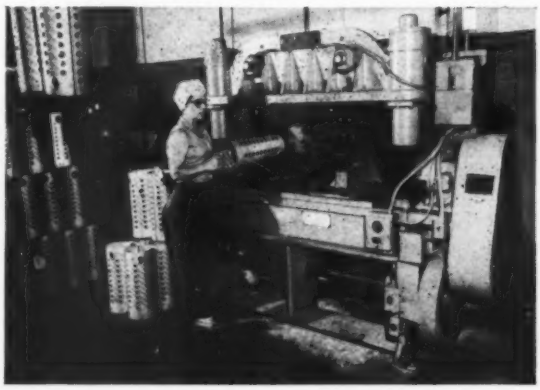
DIAMOND MULTI-MAX PUNCH PRESS MODEL 5036 ILLUSTRATED

OPEN THROAT PRESSES...

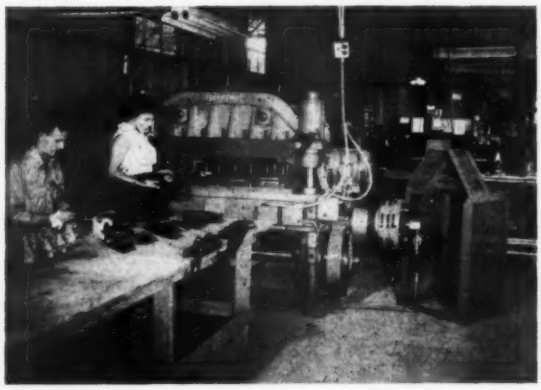
with long bed and ram areas illustrated in a new catalog, "Profit From Presses". Twenty pages with case history photographs such as illustrated below. Diamond Multi-Max punch presses are available in 30 and 50 tons capacity, 100 tons on special order. Six models for your selection. 24", 36", 48", 60", 72" and 84" working surfaces of bed and ram lengths. Air clutch and air brake at no extra cost. Mail in above coupon for your copy of this catalog, or writeon your letterhead.



SALES AND SERVICE IN ALL PRINCIPAL CITIES



SOLAR AIRCRAFT COMPANY, SAN DIEGO, one of three Multi-Max presses used by Solar Aircraft Company in perforating parts of combustion chambers for jet engines. Large bed area required for two stage dies. Large shut die height required for insertion and removal of bulky combustion chambers.



SAURENMAN COMPANY, INC., EL MONTE, assembling and riveting Saxton Kant-Twist clamps on a Multi-Max press. Large press bed area is required for the permanent installation of nine dies for riveting nine different size clamps from one inch opening to twelve inch opening. Advantage of this permanent multiple die set up is in riveting various size clamps.

DIAMOND MACHINE TOOL CO.

DIAMOND MACHINE TOOL CO.

PICO, CALIFORNIA

CIRCLE INFORM-A-GRAM KEY NO. 28

SEVENTEENTH ST., RACINE, WISCONSIN

CIRCLE INFORM-A-GRAM KEY NO. 27

over 8,000 Different Cylinder SELECTIONS—

Miller AIR AND HYDRAULIC CYLINDERS AND BOOSTERS "IN STOCK" for immediate delivery...

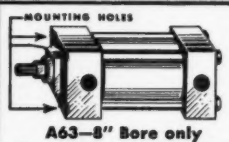
See Miller Bulletins A-105K (Air) and H-104K (Hydraulic) for Complete Dimensions and Engineering Data on these "in-stock" sizes and other Custom Miller Cylinders in bores up to 20" and strokes up to 22 feet.

"IN-STOCK" MODELS

"A" Signifies Miller 200 psi Air Cylinders; "H", 2000 psi Hydraulic Cylinders. Interchangeable Mountings Are Shown In Red On Drawings.

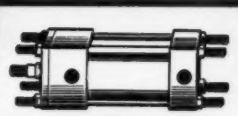
A61 and H61 Flange Mounting on Rod End (A61 not available in 8" bore)

A62 and H62 Flange Mounting on Cap End (A62 not available in 8" bore)



A63—8" Bore only Flange Mounting on Rod End

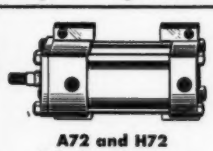
A64—8" Bore only Flange Mounting on Cap End



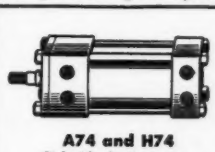
A50 & H50—Tie Rods not extended beyond nuts.
A51 & H51—Tie Rods extended both ends (shown).
A52 & H52—Tie Rods extended. Cap End only.
A53 & H53—Tie Rods Extended. Rod End only.
A54 & H54—Two Tie Rods extended at both ends.

H65—Hydraulic Only Flange Mounting on Rod End

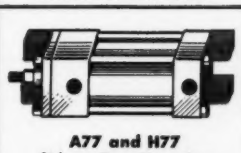
H66—Hydraulic Only Flange Mounting on Cap End



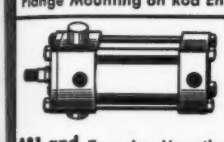
A72 and H72 Side Lug Mounting



A74 and H74 Side Flush Mounting

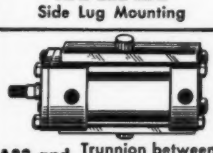


A77 and H77 Side or Foot Mounting

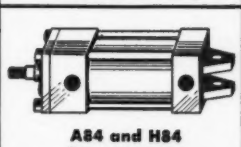


A81 and H81 Trunnion Mounting on Rod End

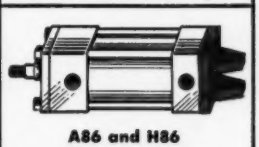
A82 and H82 Trunnion Mounting on Cap End



A83 and H83 Trunnion between Head and Cap (one week delivery)



A84 and H84 Pivot Mounting



A86 and H86 Pivot Mounting

IN-STOCK BORES

	BORES	ROD DIA.	ROD TURN DOWN & THREADS	"IN-STOCK" STROKES (in Inches)																				
AIR	1½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12								
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12								
	2	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	2½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	3¼	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	4	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	5	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	6	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	8	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
HYDRAULIC	1½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12									
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12									
	2	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	2½	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	3¼	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	4	1¾"	1¼-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	5	2"	1½-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36

① "A" and "H" Models 82, 84 and 86 with strokes over 18" require stop tubes.

Column strength requires larger diameter piston rods for the following:

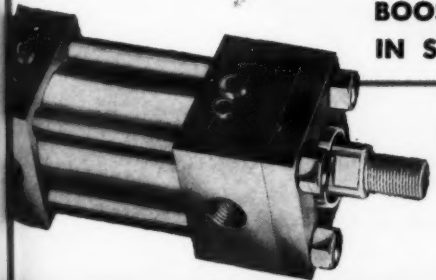
Air Cylinder Models A82, 84, and 86 with strokes inside area (1), when operated at 100 psi and over;

All hydraulic models with strokes inside area (2) and Models H82, 84, and 86 with strokes in area (4), when operated at 2000 psi and over;

Models H82, 84 and 86 with strokes inside area (3), when operated at 1000 psi and over.

Depending upon Trunnion Pin location, "A" and "H" Models 83 with standard diameter piston rods can have longer strokes than Models 82, 84 and 86.

See Miller File #251 for oversize piston rod and stop tube requirements.



BOOSTERS IN STOCK

Immediate Delivery on the following Miller 25 to 1 Ratio Boosters (80 psi air input produces 2000 psi hydraulic oil output): Model B4, 5" bore, 1" dia. ram, 6" and 12" strokes; Reciprocating Booster Model DA77-RBA8, 5" bore, 1" dia. ram, 6" stroke. Also Booster Tanks, 5" dia., 6" and 10" heights.

Write For Catalog and Stock Price List

Miller

MILLER FLUID POWER DIVISION FLICK-REEDY CORP.

2046 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

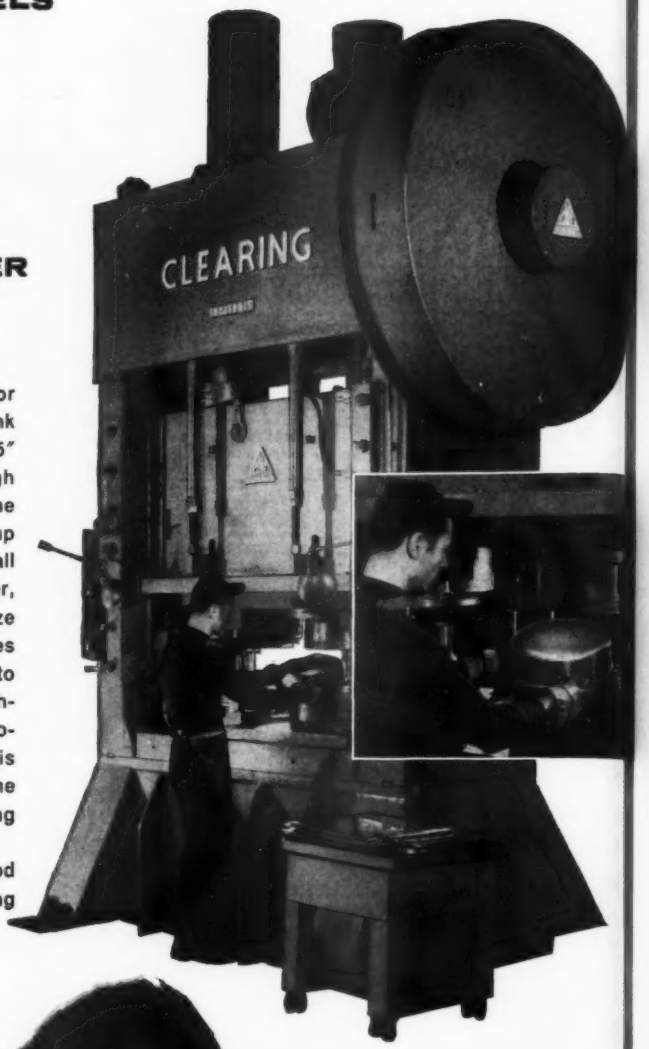
PRODUCING PRESSURE VESSELS

Profitably

CLEARING PRESS RIGHT ANSWER FOR TAIT MFG. CO.

Tait Mfg. Co. in Dayton, Ohio found the right answer for production of pressure vessels in the Clearing double crank press shown here. The vessels are produced from .025″ stainless steel blanks which are drawn to a depth of 5″. High blankholding pressure (70 tons) required at the start of the draw requires that the press develop high tonnage 5″ up from bottom stroke. Normally these requirements would call for a press far larger than the one shown at right. However, Clearing engineers designed the press with an oversize drive—a 500-ton drive in a 250-ton frame. Two sets of dies are used in the press, one to trim and draw, the other to pierce and emboss. The press is equipped with two cushions in the bed. Seventy tons of cushion pressure is provided on the draw side for blankholding. This pressure is reduced to 35 tons automatically at a point 1½″ down on the draw. The other cushion provides 10 tons of stripping pressure.

If you are looking for an efficient and economical method to produce your product more profitably, call on Clearing Machine Corporation to discuss your problem.



This Clearing double crank press with an oversize drive develops high tonnage five inches from bottom stroke, easily solving the problem of a 5″ draw in stainless steel.

Write for colorful brochure, "Thinking about a better way to do the job?" No obligation.

CLEARING PRESSES

THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION *Division of U. S. INDUSTRIES, Inc.*

6499 W. 65th Street, Chicago 38, Illinois • Hamilton Plant, Hamilton, Ohio

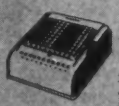
CIRCLE INFORM-A-GRAM KEY NO. 30

FOUND WHERE FINE BUSINESS MACHINES ARE "BORN"

GRAND RAPIDS GRINDERS

INTERNATIONAL BUSINESS MACHINES

SMITH-CORONA



COMPTOMETER

REMINGTON RAND

UNDERWOOD

R. C. ALLEN

Producing an intricate business machine requires exceptional toolroom precision. That's why these manufacturers use Grand Rapids Grinders . . . engineered to achieve extraordinary grinding precision at cost-cutting speed.

Model No. 55, at right, offers such features as one-piece column and base for permanent, vibrationless alignment, wheel head with powered rapid vertical travel, hydraulically actuated cross feed and longitudinal travel table. And it's the fastest grinder of its size and type, with a variable table speed up to 125 fpm!

Whether you make business machines or bulldozers, you can count on Grand Rapids Grinders for maximum toolroom precision.

GRAND RAPIDS NO. 55 HYDRAULIC FEED SURFACE GRINDER. Table speed up to 125 fpm. Working surface of table is 12" x 36". Vertical movement of wheel head is 18". Preloaded ball bearing spindle greased for life. Spindle speeds 1925 and 2500 rpm.

GALLMEYER & LIVINGSTON

A note on your letterhead will bring complete details.

GALLMEYER & LIVINGSTON COMPANY

495 Straight Ave., S.W., Grand Rapids, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 31

newest addition
to the BUCKEYE
family of
abrasive tools

little JEFF
the
MINI-GRINDER

Weighs in at a mere 3½ ounces!
Only 3¾" long!
Powerful vane-type motor.
Capacity: ½" mounted points. (⅛" collet)
All ball-bearing construction, easy to service.

FOR FINELY DETAILED, PRECISION GRINDING
IN TOOL ROOM OR ON PRODUCTION

At 50,000 RPM, this tiny Buckeye Mini-Grinder stirs up a storm of power that gets an amazing amount of work done in a hurry. No bigger—or heavier—than a pen-type flashlight, the Mini-Grinder can be used for precision grinding in the smallest work areas. Sturdy, all-steel construction. Complete kit, packaged in sturdy tool box, includes mounted points, hose and connections, vitalizer (lubricator-filter), wrenches and dressing stone.

Catalog A-10 contains data and specifications on all Buckeye abrasive tools—write for your copy today!

Buckeye Tools CORPORATION
DIVISION 19 • DAYTON 1, OHIO

producers of the world's first successful rotary air tools

CIRCLE INFORM-A-GRAM KEY NO. 32

. . . Month's Talk from Page 16

ment and its vendors. It is extremely annoying to government contractors to find that different government inspection organizations operate in accordance with different policies, different procedures, and different forms. Such diversity does not enhance efficiency and, in time of emergency, it is an unnecessary drag on mobilization.

When all is said and done, the need for standardization in inspection and Quality Control derives from the basic fact that in military procurement the government of the United States cannot afford to waste man-hours, machine-hours, or material because of inability or unwillingness of its inspection personnel to speak the same language.

McMillen Elected to Head ASTE

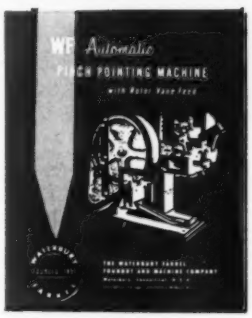
Howard C. McMillen, newly-elected president of the American Society of Tool Engineers, is plant manager of Philco Corporation's Bedford, Indiana, plant. He succeeded Dr. Harry B. Osborn, Jr., technical director of TOCCO Division, Ohio Crankshaft Company, as head of the 33,000-member organization at the ASTE annual meeting in Chicago.

The twenty-fifth president of the ASTE, McMillen is an engineering graduate of Purdue University and has been an engineering and manufacturing executive for more than 25 years. He was associated with several divisions of General Motors Corporation and with Seeger Refrigerator Company before assuming his present post with Philco.

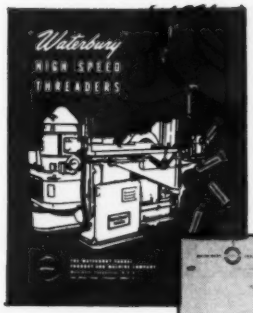
Other society officers elected at Chicago are: H. E. Collins, manager, Process Engineering Department, Hughes Tool Company, Houston, first vice president; G. A. Goodwin, chief process engineer, The Master Electric Company, Dayton, Ohio, second vice president; Wayne Ewing, president, Arrowsmith Tool and Die Co., Inc., Los Angeles, third vice president; H. Dale Long, president, Scully-Jones & Company, Chicago, fourth vice president; John X. Ryneska, manager of purchasing, General Electric Company, West Lynn, Mass., treasurer; and William Moreland, vice president, Meyers Pump Co., Ashland, Ohio, secretary.

The ASTE now has 130 chapters in all the leading manufacturing centers in the United States and Canada.

☐ **"Waterbury" Automatic Nut Formers**
Cir. No. 930-A-2
Describes operation and illustrates design details of machine which can cold forge a wide variety of standard and special nut blanks as well as similar parts. Production rates range from 60 to 125 per minute depending upon size of machine. Gives specifications for 5 sizes ranging from ¼" to ¾" nominal bolt capacity. 8 pages.

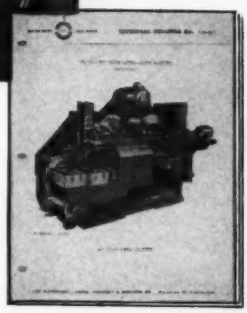


☐ **Automatic Pinch Pointing Machine**
Cir. No. 742-A-2
Describes and illustrates rotor vane feed pinch pointer with maximum production capacity of 150 per minute. Max. blank diameter ¼". Max. length under head 2½". Min. length under head ¼". Shows typical work samples and gives table of specifications.



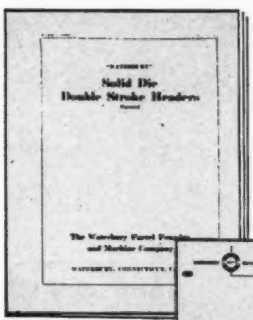
☐ **High Speed Threader**
Cir. No. 942-A
Describes and illustrates completely new type of thread rolling machine which uses planetary dies to thread up to 2,000 blanks per minute.

☐ **High Speed Screw Slotter**
Bul. No. 106-A-3
Describes and illustrates WF's revolutionary new slotter—production team-mate of the new threader. Uses single feed mechanism and single saw to slot up to 2,000 burr-free blanks per minute.

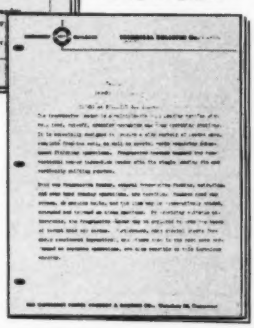


ARE YOU UP-TO-DATE ON WF BOLT, NUT & SCREW MACHINERY?

Send For Your FREE Copy Of These NEW Bulletins



☐ **"Waterbury" Solid Die, Double Stroke Headers**
Cir. No. 933-A-2
Explains construction and operating features of crank type, two blow headers for producing the standard varieties of bolt and screw blanks as well as many special cold-forged products. Gives specifications for five sizes of long stroke and five sizes of short stroke machines handling wire diameters from 3/16" to ½". 8 pages.

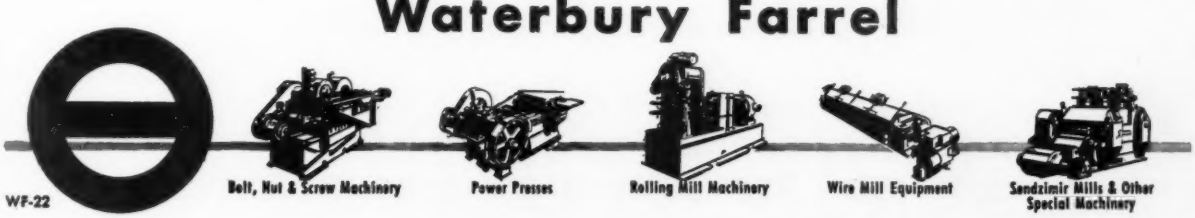


☐ **"Waterbury" Progressive Headers**
Bul. No. 104-A-2
Covers features of multiple die cold heading machine which has roll feed, cut-off, transfer mechanism and four operating stations. Points out that machine can produce wide variety of headed work including hexagon head cap screw blanks and socket head cap screw blanks. Four sizes of headers are covered in the specification tables. 8 pages.

Write for circulars by number or check the ones you want and simply mail this page with your name and address to —

WATERBURY FARREL FOUNDRY & MACHINE COMPANY
Waterbury, Connecticut
Offices: Chicago, Cleveland, Millburn, N. J.

Waterbury Farrel



WF-22

CIRCLE INFORM-A-GRAM KEY NO. 33

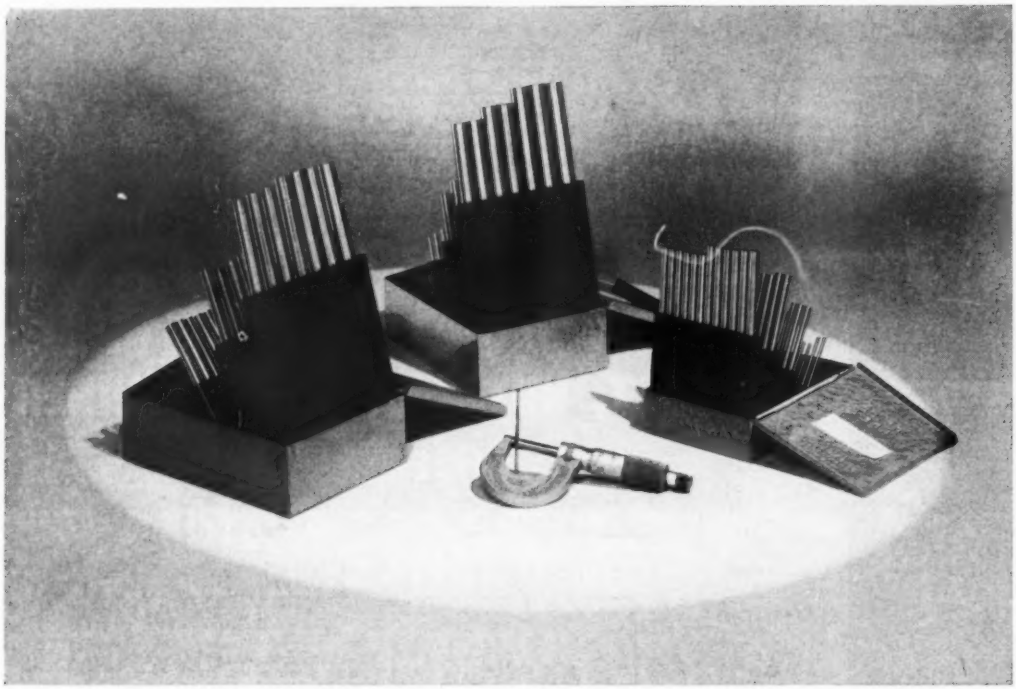
DRexel 6-4222

WM. T. HUTCHINSON CO.

53 BROWN AVE.
SPRINGFIELD, NEW JERSEY

ESTABLISHED 1927

HUTCHINSON HSS BLANKS



115 Pieces – COMPLETE – .040" to .500" – $88.00

JOBBER SET	LETTER SET	WIRE SET
$32.27	$29.03	$27.40
in Huot Index	in Huot Index	in Huot Index

(PRICES SUBJECT TO QUANTITY DISCOUNT)

HIGH SPEED STEEL — 64 "C" scale hard — gage tolerance — mirror finish.

parallel ground +.0002 —.0000

ANY DECIMAL DIAMETER OF STANDARD LENGTH .020" TO .750" SHIPPED ON 24 HOUR NOTICE

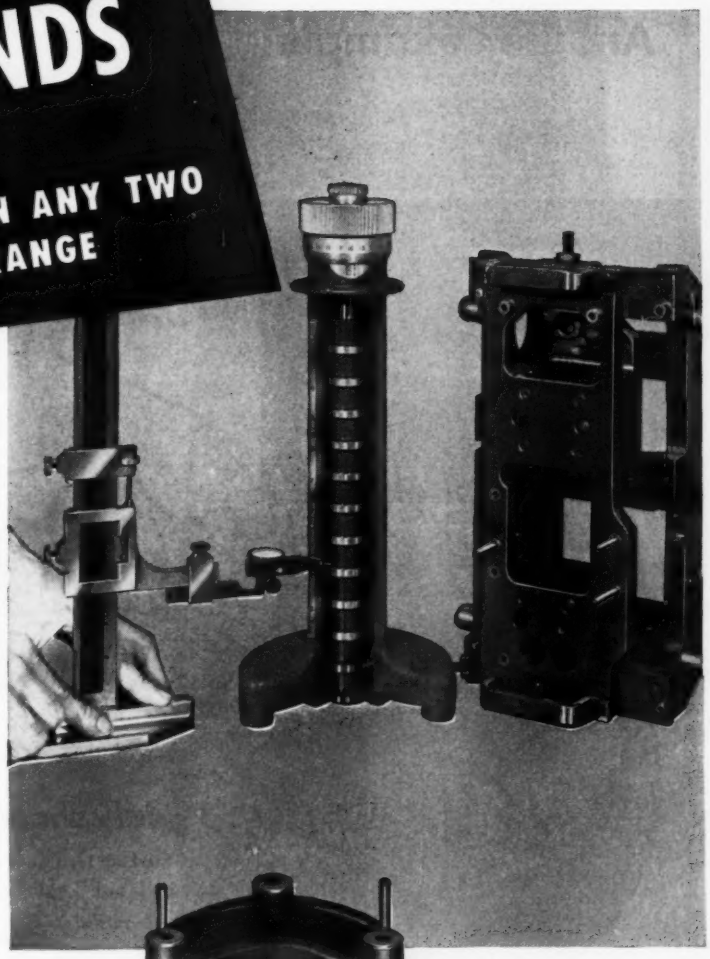
CIRCLE INFORM-A-GRAM KEY NO. 34

SETTING TIME:

10 SECONDS

ACCURACY:

.00005" BETWEEN ANY TWO POINTS IN 12" RANGE



Cadillac PLA-CHEK

SPEEDS ACCURATE INSPECTION from *MINUTES* to *SECONDS*

Designed for easy portability and extreme ruggedness, this 12" Cadillac PLA-CHEK takes little more than 10 seconds to set! Permits surface plate checking and inspections nearly 5 times faster than by ordinary methods.

And, accuracy is assured! Between any 2 points in the 12" range accuracy is guaranteed within .00005".

With a reverse checking plate, a height-gage indicator is easily set for checking the underside of parts. Use of inside micrometers, telescoping and internal cylinder gages gives this gage added versatility. Send coupon TODAY for complete details!

To increase the usefulness of the 12" Cadillac PLA-CHEK Gage, without sacrificing portability, this 6" precision-made riser may be used—upping range to 18".

Cadillac

GAGE COMPANY

P. O. BOX 3806 • DETROIT 5, MICHIGAN

MAIL THIS COUPON FOR COMPLETE DATA

CADILLAC GAGE COMPANY
P. O. BOX 3806, DETROIT 5, MICHIGAN

Without obligation please rush complete information on the Cadillac PLA-CHEK Gage line to:

Name_____

Company_____

Address_____

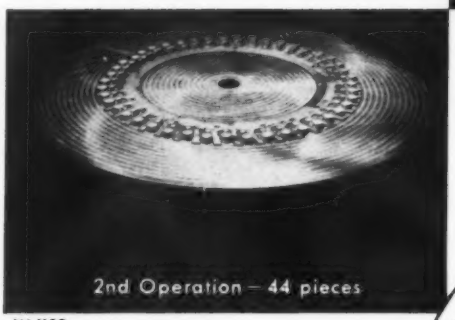
City_____ Zone____ State_____

CIRCLE INFORM-A-GRAM KEY NO. 35

Another example

W-1138

# of Blanchard versatility



W-1139

No. 303 Stainless Steel Forging

653 oddly shaped, non-magnetic workpieces

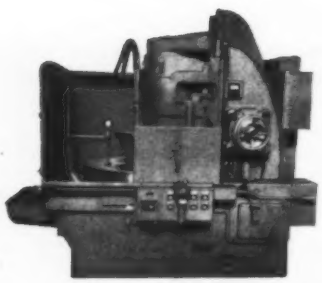
Blanchard Surface Grinders are noted for their unusual versatility—like grinding small, non-magnetic stainless steel forgings in quantity.

In the first operation, 653 forgings are loaded and blocked between rings on a No. 18 Blanchard, with 36" magnetic chuck (stock removal .010"). Parts, chuck and rings are sprayed with oil, and molten sulphur is poured around the parts to hold them. After grinding, the sulphur is easily stripped away.

This entire operation takes only 1½ hours—including preparation of the sulphur.

In the second operation, 44 pieces are set in a notched steel ring. Tilting the wheelhead and maintaining wheel pressure in one direction holds these non-magnetic pieces in the notches. Stock removal from this surface is .030", to tolerance of ±.003. Each load takes eight minutes—floor-to-floor.

As a result of this ingenious workholding, each piece is ground on both sides in a fraction of a minute, at less than 98¢ abrasive cost for all 653! That's typical of the convenience and economy of grinding on a Blanchard—whether the parts are magnetic or non-magnetic!



Send for free copies of "Work Done on the Blanchard", 4th edition, and "The Art of Blanchard Surface Grinding", 3rd edition—recently revised.

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

CIRCLE INFORM-A-GRAM KEY NO. 36

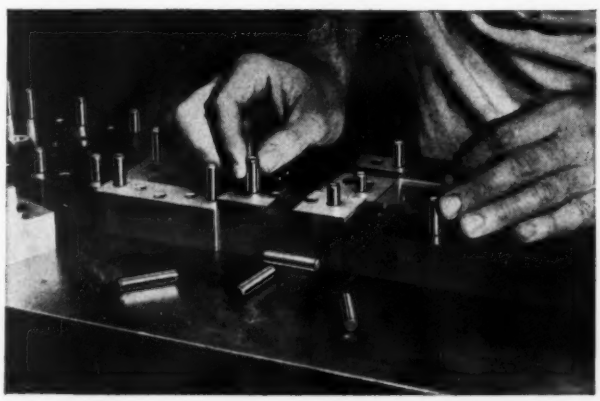
"STOCK ANSWER"
to many a design problem

ALLEN DOWEL PINS

ALLEN DOWEL PINS are being profitably employed in a thousand and one ingenious ways beyond their conventional applications in tool and die work — as economical roller bearings, as axles, precision plugs, hinges and wrist pins to name a few.

If you have an application that will utilize the great strength, accuracy and fine finish of Allen Dowel Pins, you can save substantially on the cost of your product — because you can secure them at favorable prices right from your Allen Distributor's stock.

Check the quick facts at the right and write directly to Allen's Engineering Department for further technical information.



SPECIFICATIONS

- Made from Allenoy heat treated steel. Surface hardness 62-64, Rockwell C scale; core hardness 52-54. Case depth .010″ to .020″ depending on size.
- Single shear strength 160,000 to 180,000 p.s.i.
- Surfaces precision ground to ± .0001″ with micro-inch finish of 6 RMS max.
- Sizes: Diameters, ⅛″ to 1″. Lengths, ⅜″ to 6″.
- Two standard oversizes — .0002 for press fits between mating parts, or .001 for repair work, or holes machined oversize.

ALLEN HEAD

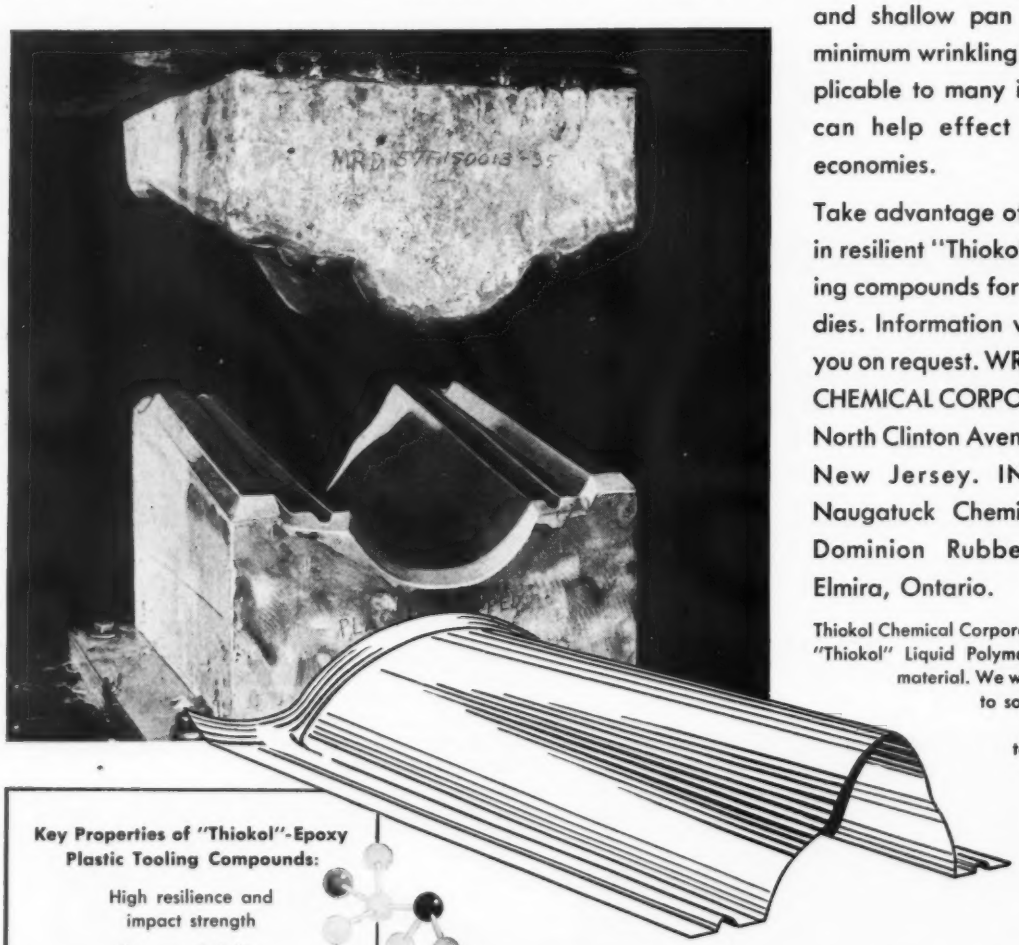
ALLEN
MANUFACTURING COMPANY
Hartford 2, Connecticut, U.S.A.

CIRCLE INFORM-A-GRAM KEY NO. 37

DROP HAMMER DIES OF PLASTIC WITH MAXIMUM IMPACT STRENGTH...FROM "THIOKOL" LIQUID POLYMER

Resilient plastic tooling compounds for impact-resistant drop hammer dies are based on epoxy resins modified with "Thiokol" Liquid Polymer.

The dies are constructed of Kirksite bodies capped with a layer of the resilient tooling compound. The caps are easily cast at room temperature to exact finish contour . . . eliminating the labor of hand grinding and scraping. Dies capped with resilient "Thiokol"-epoxy compounds produce duct halves, beads, angles, channels and shallow pan sections with minimum wrinkling. They are applicable to many industries and can help effect real tooling economies.



Take advantage of the economy in resilient "Thiokol"-epoxy tooling compounds for drop hammer dies. Information will be sent to you on request. WRITE: THIOKOL CHEMICAL CORPORATION, 784 North Clinton Avenue, Trenton 7, New Jersey. IN CANADA: Naugatuck Chemicals Division, Dominion Rubber Company, Elmira, Ontario.

Thiokol Chemical Corporation manufactures "Thiokol" Liquid Polymer only as a raw material. We will gladly refer you to sources of supply of "Thiokol"-epoxy tooling compounds.

Key Properties of "Thiokol"-Epoxy Plastic Tooling Compounds:

- High resilience and impact strength
- Easy workability
- Room temperature processing
- Exact reproduction
- Outstanding adhesion

Thiokol®

PIONEER MANUFACTURERS OF SYNTHETIC RUBBER

CIRCLE INFORM-A-GRAM KEY NO. 38

not just brass but

Titan brass

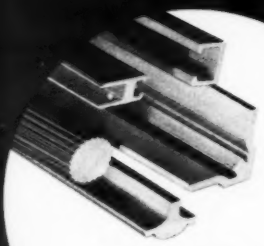
mill products...for your metal money's worth

Brass rounds available from 1/16" to 10" diameter.

Rounds

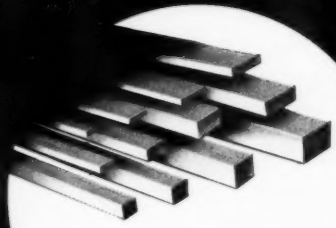
Extruded, drawn, machine-straightened . . . from 1/8" to 4".

Hexagons & Octagons



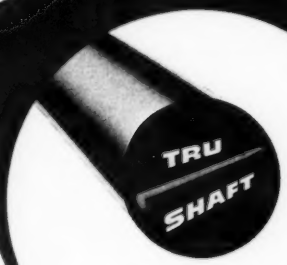
Extruded to your exact requirements.

Special Shapes



Squares up to 4¼". Rectangles extruded, drawn and straightened--up to 5" maximum diagonal.

Rectangles & Squares



Bronze boat shafting . . . tough, strong, corrosion-resistant Titan Naval Brass.

Tru Shaft

High-quality wire for making brass rivets, bolts, screws, other fasteners . . . available in either 65-35 or 70-30 copper-zinc alloys.

Wire

All Titan rod mill products are of highest quality brass. All sizes of finished Titan dies are ready for production and prompt delivery.

Rounds, hexagons, octagons, rectangles, squares and special shapes can be delivered in the following brass alloys: Free-Cutting Brass, Naval Brass, Leaded Naval Brass, Manganese Bronze. Extruded Leaded Nickel-Silver and Free-Cutting Commercial Bronze in limited sizes and shapes.

Send us your order.

If you want more details on Titan rod and wire mill products, send coupon below:

Dept. U-20
Titan Metal Manufacturing Co., Bellefonte, Pa.
Gentlemen:

☐ Please send 20-page brass mill products booklet — "For Your Metal Money's Worth."
☐ Please have your representative call.

Name..... Title.....
Company.....
Address..... City & State.....

Titan

METAL MANUFACTURING COMPANY

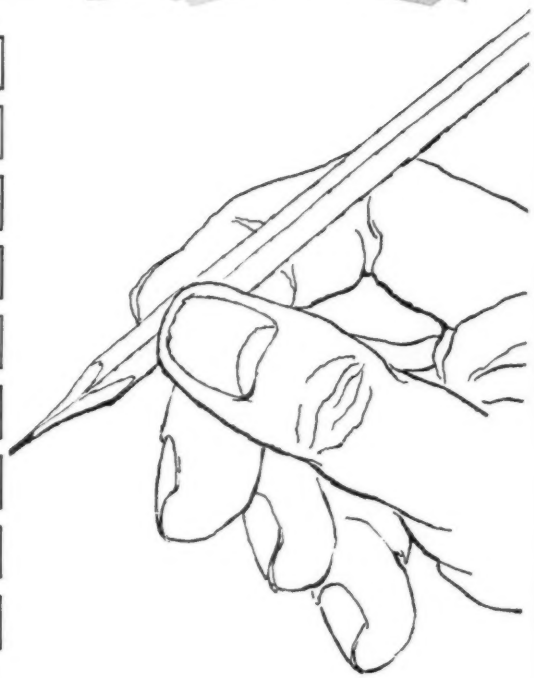
Bellefonte, Pa. Offices and Agencies in Principal Cities

RODS · FORGINGS · DIE CASTINGS · WELDING RODS · WIRE

Quality Alloys by Brass Specialists

what's your TAPPING PROBLEM?

- Maintaining tolerance ☐
- Lead error ☐
- Excessive tap breakage ☐
- Blind hole tapping ☐
- Rejects too high ☐
- Slow production ☐
- More capacity ☐
- Lack of skilled help ☐
- Excessive clutch maintenance ☐



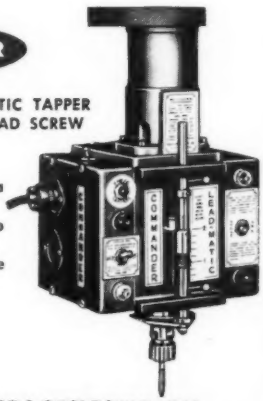
If you've checked *any* of the above—
you need *one* or *both* of these Commander tappers.

Commander TAPPER

- "The tapper that thinks for its operator"
- Handles the range #0 to 3/4-16
- Fits any drill press

LEAD-MATIC TAPPER

AUTOMATIC TAPPER WITH LEAD SCREW



- Makes any drill press a precision tapping machine
- Handles the range #0 to 3/4-16
- Electrically controlled cycle or jog tapping actions

Commander Production Tools

Commander MANUFACTURING CO.

4228 W. KINZIE STREET • CHICAGO 24, ILLINOIS

The Commander catalog has complete information on COMMANDER TAPPERS and many other cost-cutting production tools. Write for it and the name of your nearby Commander Distributor today.

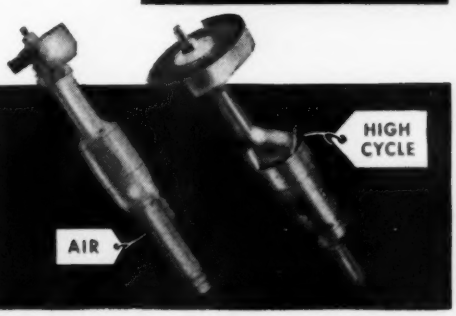
CIRCLE INFORM-A-GRAM KEY NO. 40

Sets 'em twice as fast!

New Rotor "02" Nutsetter cuts job time 50%

Nutsetters here, on radio chassis assembly, operated at 1200 rpm. Changed to Rotor S-02 LC Air Nutsetter . . . operates at 2500 rpm and handles easier. Cut time in half. Savings paid for Rotor tool in 7 weeks. Let's see what we can do for *you* with the new Rotor tools! Ask for Bulletin 46.

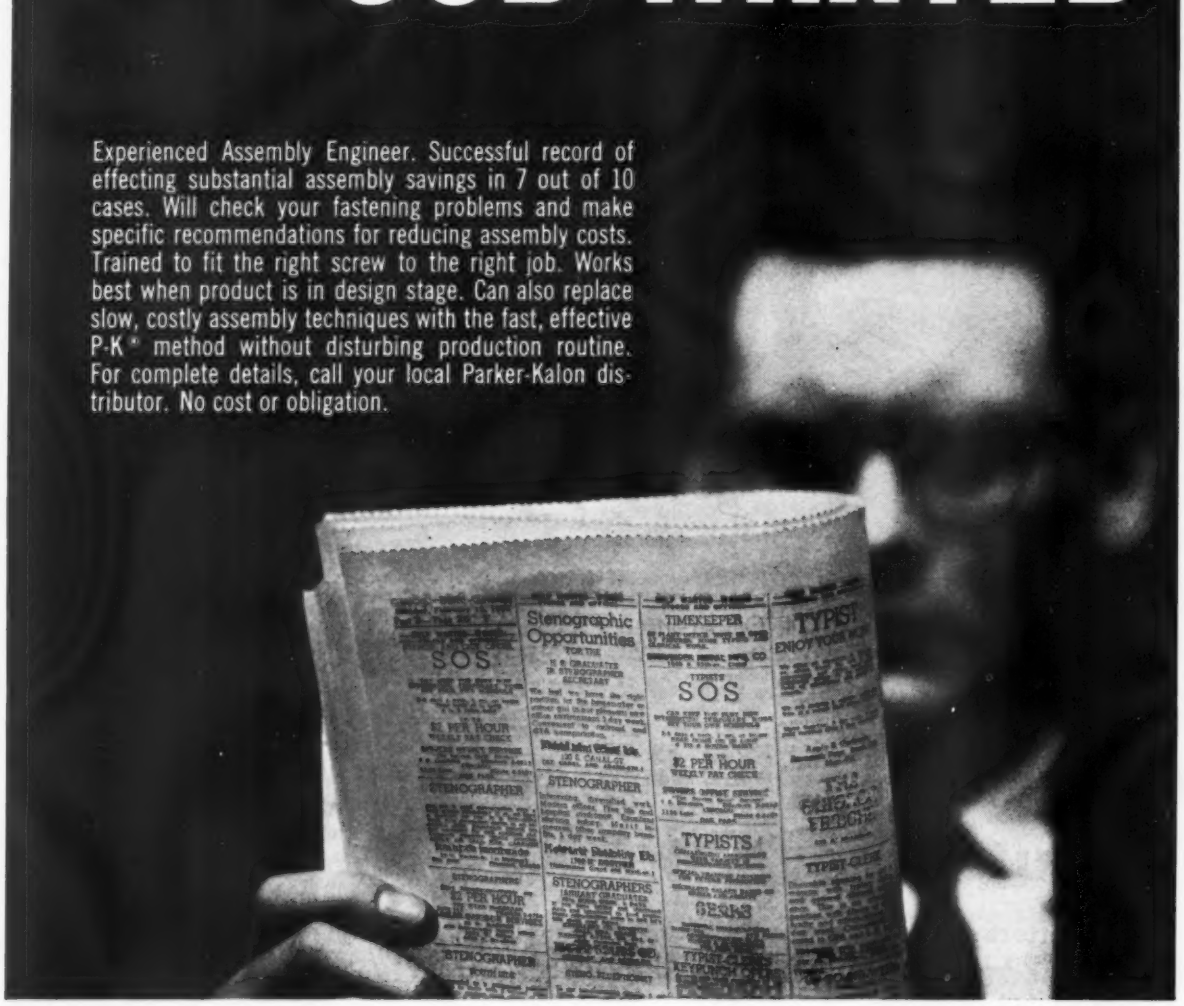
THE ROTOR TOOL CO.
CLEVELAND, OHIO



CIRCLE INFORM-A-GRAM KEY NO. 41

JOB WANTED

Experienced Assembly Engineer. Successful record of effecting substantial assembly savings in 7 out of 10 cases. Will check your fastening problems and make specific recommendations for reducing assembly costs. Trained to fit the right screw to the right job. Works best when product is in design stage. Can also replace slow, costly assembly techniques with the fast, effective P-K® method without disturbing production routine. For complete details, call your local Parker-Kalon distributor. No cost or obligation.



this specialist wants to work for you!

Call in a P-K Assembly Engineer and find out how you can profit through reduced assembly costs the P-K way. Take advantage of this unique Parker-Kalon service—another of the many reasons why users say—"if it's P-K . . . it's O. K."

PARKER-KALON DIVISION, GENERAL AMERICAN TRANSPORTATION CORPORATION—CLIFTON, NEW JERSEY

PARKER-KALON® *fasteners*

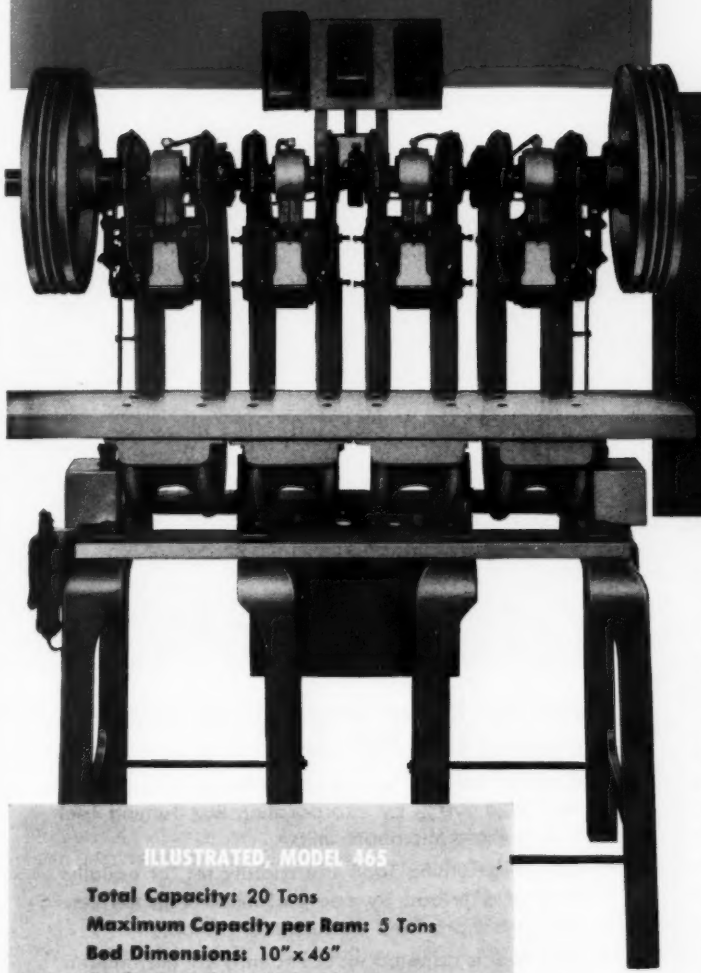
Sold Everywhere Through Leading Industrial Distributors. Warehouse in Chicago, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 42

HOW TO LICK BIG PRESS JOBS WITH LOW COST EQUIPMENT!

and make capital savings up to 50% or more!

Do you have jobs requiring the bed area of large presses but necessitating only limited tonnage? Then this Benchmaster MULTIPLE RAM Press fills your exact requirements. Designed especially to win back a highly competitive market for one customer by cutting costs and increasing production, *it does a number of jobs better than any existing equipment!*



- Provides unusually large bed area.
- Greatly reduces press investment.
- Facilitates progressive die operations.
- Enables use of separate tooling at each progressive stage.
- Reduces tooling maintenance and expense.
- Permits substitution of duplicate dies at individual stations with little loss of press time.
- Increases production 200 to 300% over large presses.

ILLUSTRATED, MODEL 465

Total Capacity: 20 Tons
Maximum Capacity per Ram: 5 Tons
Bed Dimensions: 10" x 46"
Stroke Length: 5/8"

Other models supplied to your specifications with choice of 2, 5 or 8 ton rams.

Any number of rams—Any number of presses can be ganged using 2 ton, 5 ton or 8 ton Benchmasters, *providing all members of the gang are of equal tonnage.* Rams can operate down simultaneously, alternately or in staggered sequence.

Any center distances—Ram distances can be separated to any requirements beyond frame limitations. Each individual ram is adjustable left or right for final line-up on individual dies.

Any type automatic controls—The unit illustrated is equipped with electric clutches; rams can be single tripped for setting up or all rams automatically operated for continuous-run set-ups. An emergency stop button halts motors and disengages all clutches simultaneously.

Automatic lubrication—All moving parts are interconnected to a common pressurized container for simultaneous, 1 shot lubrication.

1835 W. Rosecrans Avenue, Gardena, California

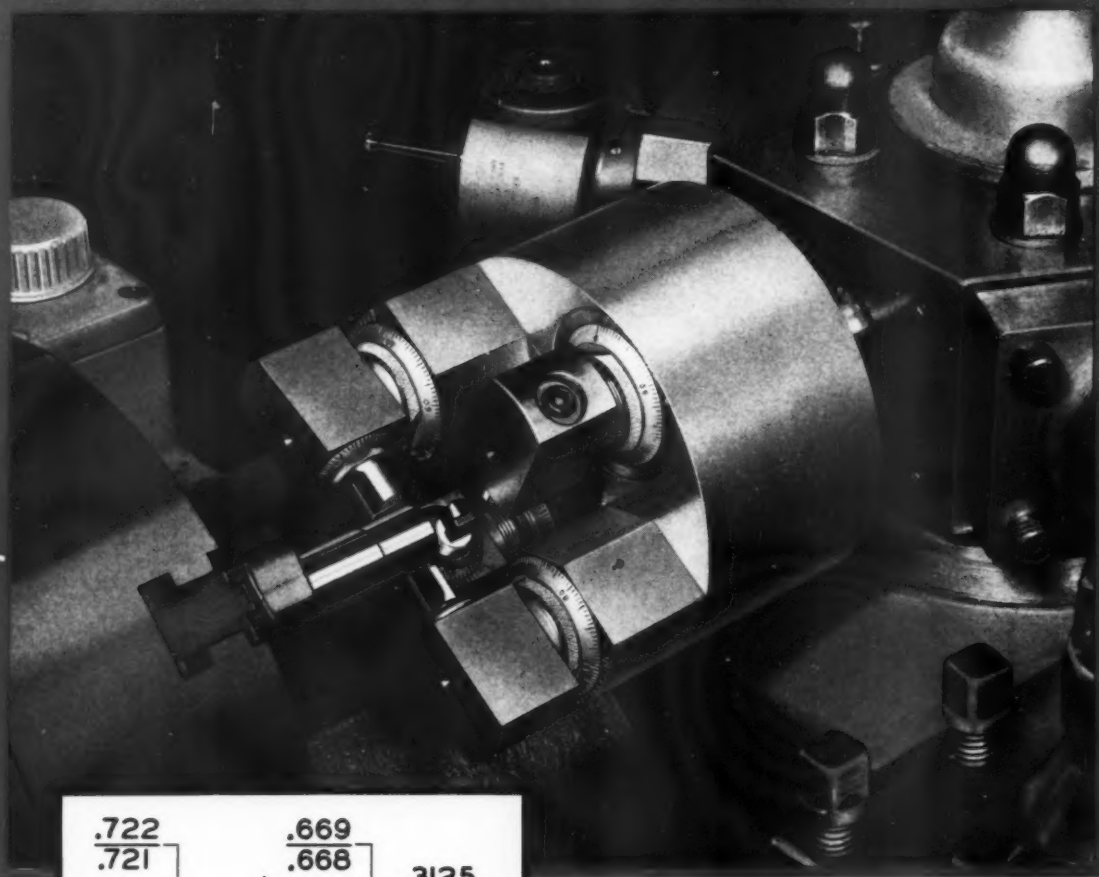
benchmaster

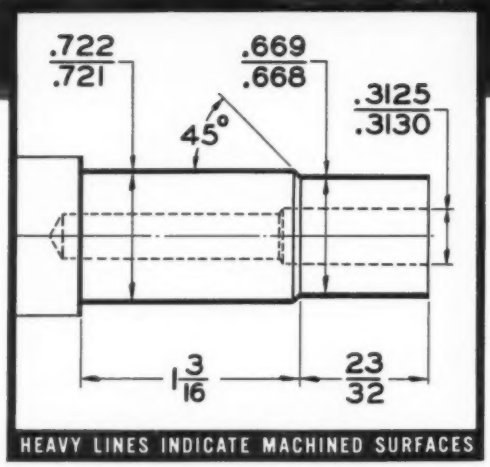
World's largest manufacturer of small punch presses and mills.

CIRCLE INFORM-A-GRAM KEY NO. 43

Microbore® PRODUCTION TOOLING

FOR PRECISION BORING, TURNING and FACING OPERATIONS





HEAVY LINES INDICATE MACHINED SURFACES

Complete facilities are available for engineering and manufacturing special Microbore equipment for all types of producton operations.

Microbore Reduces Setup and Machining Times on Turret Lathe Operations

Rates of feed on turning operations were increased 100% by incorporating Box Turning Tool with multiple Microbore units.

Opposed Turning Tools are rapidly set for equally divided chip load by means of micrometer vernier adjustment provided at each tool station.

Each tool is adjusted independently by micrometer vernier principle for radial and linear settings which provide accurate and rapid settings of tools for shoulder dimensions and turned diameters.

SEND US YOUR TOOLING PROBLEMS

DE VLIEG MICROBORE

DE VLIEG MICROBORE • DIVISION OF DE VLIEG MACHINE COMPANY

2720 West Fourteen Mile Rd., Royal Oak, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 44

★ ★ ★

MONTREAL HOST TO 10TH Q-C CONVENTION

More than 80 speakers from the United States, Canada, and Europe are scheduled to discuss all phases of Quality Control, industrial statistics, and operational research when Montreal, Canada's "Convention City," plays host to the American Society for Quality Control's Tenth Annual Convention, June 6, 7, and 8. This marks the first time the convention is being held in Canada.

In connection with the technical sessions, makers of gages and inspection equipment will have a full array of their latest developments on display at the convention headquarters, Le Palais du Commerce. Many industries, in addition, are expected to show Q-C techniques used by them in their operations, at the exhibits.

Plant tours have been arranged to give convention-goers an opportunity to see how statistical quality control techniques are applied in Canadian industries. The Dominion Rubber Company; the ammunition plant of Canadian Industries, Ltd., at Brownsburg; the cable plant of the Northern Electric Company; and the Imperial Tobacco Company will open their doors to ASQC "tourists" on Thursday and Friday, June 7 and 8.

★ ★ ★

A faster and cooler cutting non-premium vitrified grinding wheel for the automotive and aviation industries has been developed by Electro Refractories & Abrasives Corp. Designed for cylindrical grinding on cam shafts, other center held grinding operations, and tool grinding, the wheel is said to give more pieces per dress.

Robert A. Horner, 66, retired Division Manager of the Machine and Small Tool Division of Barber-Colman Company, died on February 28.

Dr. Eugene Casson Crittenden, 75, internationally known scientist and expert on standards of physical measurement and retired Associate Director of the National Bureau of Standards, died March 28 at Garfield Hospital, Washington, D. C.

Alfred D. Beeken, Jr., vice president sales of the Vulcan Crucible Steel Division, H. K. Porter Company, Inc., died unexpectedly at his home at Beaver, Pa., on March 26.

How UNITED AIR LINES Protects Safety Record and Reduces Operating Costs with . . .

3-D Micro-Vision

At the world's largest commercial aircraft maintenance base, in South San Francisco, Bausch & Lomb Stereomicroscopes play an important part in insuring the safety and efficiency of United Air Lines planes. For 15 years inspectors have been using these optical aids for quick, sure identification of defects in cams, bearings, gear teeth, plating, connecting rods, and many other engine parts. Cracks, plating inclusions, rough surfaces which might cause wear—they all show up vividly in natural 3-dimensional detail. These critical inspections, made during regularly scheduled engine overhauls, catch failures *before* they happen. The result: dependable safety . . . lower operating cost.

FREE! GET THIS EXCLUSIVE 3-D MICRO-VISION BOOK

- See actual stereo views!
- Know *how* and *where* to use Stereomicroscopes!
- Fit exact model to job needs with unique Selector-Chart!

Write TODAY for Manual D-15. Bausch & Lomb Optical Co., 77305 St. Paul St., Rochester 2, N. Y.

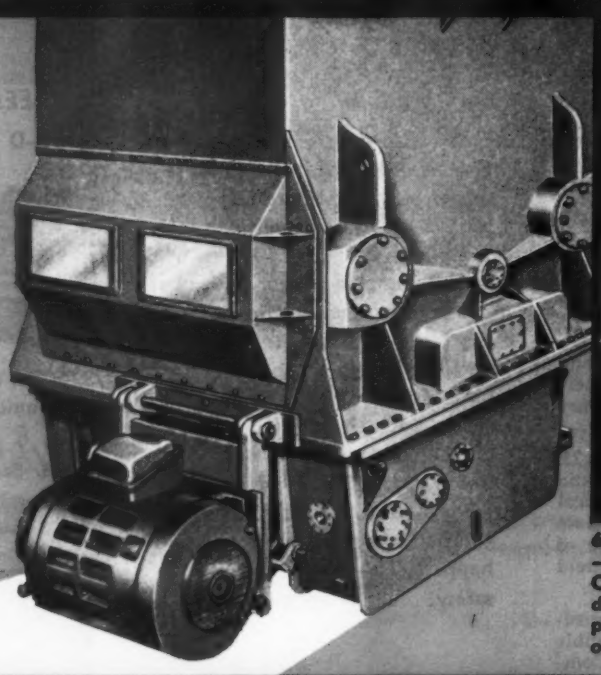
BAUSCH & LOMB SINCE B&L 1853

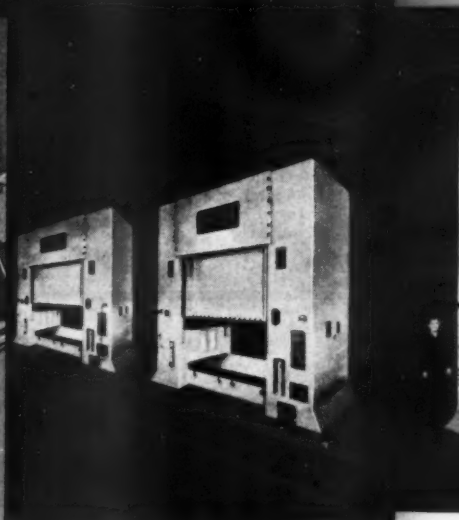
STEREOMICROSCOPES

America's only complete optical source . . . from glass to finished product

CIRCLE INFORM-A-GRAM KEY NO. 45

Now A NEW BLISS PRESS





600-TON PRESSES IN ASSEMBLY
—Shown in assembly at Bliss' Canton, Ohio plant are these three underdrive presses. More than half of each press is beneath floor level. Note observation "ports" in the uprights.

COMBINES LINK-TYPE MECHANISM WITH *Underdrive*

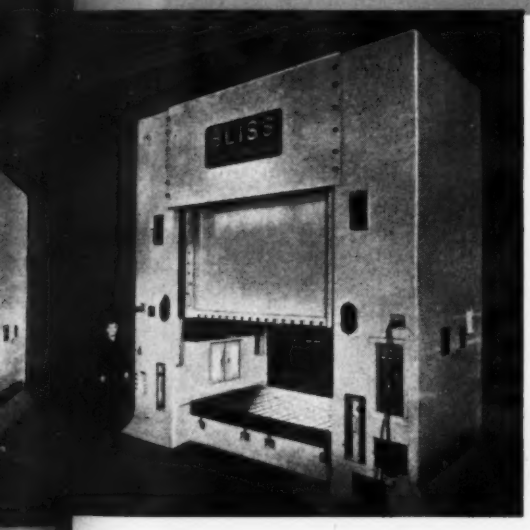
ROCKSHAFT IN NEW UNIT PROVIDES MAXIMUM PRESSURE ON DIES WITHOUT COMING TO BOTTOM DEAD CENTER

A completely new development in press design now offers press users the famous Bliss link-type drive in a low-slung "pull-down" press. The reduced headroom required makes the new press ideal for installation in modern one-story plants.

The link-drive rockshaft mechanism has been designed to come to within a few degrees of bottom dead center when the slide is down. This develops maximum pressure on the dies and eliminates a major cause of sticking.

Bliss engineers evolved the new design from the link-type overdrive press, which Bliss developed and introduced two decades ago. The "non-sticking" advantage of the new press is only one of the reasons why many have already been ordered by automotive manufacturers. Built to J.I.C. standards, these "packaged" units have all piping and wiring for press controls, automatic work-handling devices and maintenance tool power outlets built into their trim, rugged uprights. Installation is simply a matter of "plugging in" electrical and other connections. Adjustment is fast and precise, thanks to the motorized worm and wheel adjustment at all corners of the slide.

These are just a few of the many design features which make Bliss' Link-Type Underdrive presses among the most modern in the world. You ought to have the complete story in your files—and *can* by writing today to our Canton office.



THESE DESIGN ADVANTAGES SLASH OPERATING AND MAINTENANCE COSTS!

- Slide gibs protected against dirt and grit in all positions of stroke and adjustment.
- Swivel mounting on counterbalance cylinders eliminates misalignment of piston rod and cylinder.
- Packaged clutch and brake unit: standardized and unitized; gear type coupling between clutch and brake unit and press.
- All main drive gearing located in single removable gear case.
- Automatic lubrication of counterbalance cylinders and cushion internals.
- Plexiglass observation windows in uprights and gear case permit easy inspection of mechanism during operation.
- Two lubrication systems—one low pressure, the other high pressure; both interlocked with the press run circuit.

E. W. BLISS COMPANY, Canton, Ohio

Presses, Rolling Mills, Rolls, Special Machinery

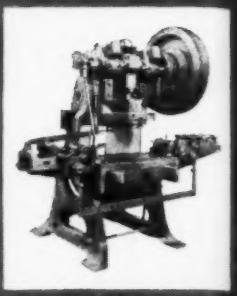
BLISS SINCE 1857

is more than a name... it's a guarantee

U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; Midland and Pittsburgh, Pa.; San Jose, Calif. *Branch Offices in* Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, San Jose, Salem, Toledo, Washington, D. C.; and Toronto, Ontario, Canada; E. W. Bliss (England) Ltd., Derby; E. W. Bliss Co. (Paris), France. *Other representatives throughout the world.*

CIRCLE INFORM-A-GRAM KEY NO. 47

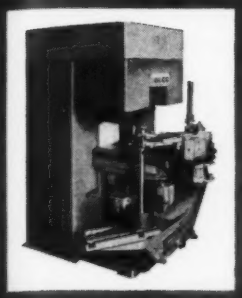
Which one is best?



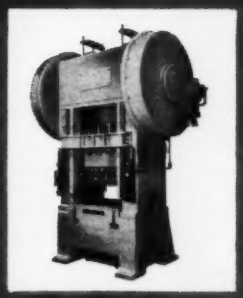
INCLINABLE . . .

Talk to the man

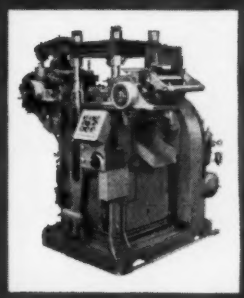
Presses and methods that automatically reduce costs



NOTCHING MACHINE . . .



STRAIGHT SIDE . . .



DIEING MACHINE . . .

n who sells ALL four

YOUR HENRY & WRIGHT - V & O PRESS REPRESENTATIVE

Yes, now you can discuss the advantages of the basic types of mechanical presses with an unbiased expert. We mean a man who sells all four (and thus has no axe to grind), knows the performance of each press and can help match objectively the requirements of your production with the press that's best for you.

Behind each of these men are two engineering organizations geared to help work out problems ranging from simple blanking to automated "packaged" presses. Your Henry & Wright – V & O Press representative will fit into your production planning team like the "pro" he is – adding his experience to yours in appraising press performance *in terms of your requirements.*

Our representative is as near to you as your telephone. The names and addresses of the companies representing us are listed on the right. Don't miss calling in these experts on any press replacement or modernization program.

EMHART MFG. CO. PRESS DIVISIONS

HENRY & WRIGHT
HARTFORD, CONNECTICUT

THE V & O PRESS CO.
HUDSON, NEW YORK

CIRCLE INFORM-A-GRAM KEY NO. 49

PHONE, WRITE OR WIRE THE H&W-V&O REP NEAREST YOU

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1807 Elmwood Ave.

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Bryant Machinery & Engineering Co.
640 W. Washington Blvd.

CINCINNATI, OHIO
The Motch & Merryweather Machinery Co.
First National Bank Bldg.

CLEVELAND, OHIO
The Motch & Merryweather Machinery Co.
1213 West Third St.
Penton Bldg.

DAYTON, OHIO
The Motch & Merryweather Machinery Co.
1305 American Bldg.

FERNDALE, MICH.
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INDIANAPOLIS, IND.
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MUSKEGON, MICH.
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PITTSBURGH, PA.
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Lepel
HIGH FREQUENCY *Induction* HEATING UNITS

BRAZING
HARDENING
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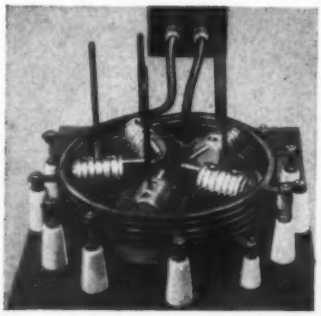
SOLDERING
ANNEALING
MELTING

The Lepel line of induction heating units represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating. With a background of half a century of electrical and metallurgical experience, the name Lepel has become the symbol for quality in induction heating equipment embodying the highest standards of engineering achievement, dependable low cost operation and safety.

If you are interested in the application of induction heating you are invited to send samples of the work with specifications of the operations to be performed. Our engineers will process these samples and return the completed job with full data and recommendations without any cost or obligation.

TYPICAL INDUCTION HEATING APPLICATIONS

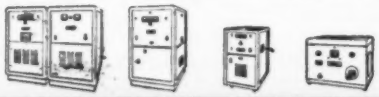


A widely used application in which several assemblies, consisting of a brass body, six radiator fins and a mounting stud, are being soldered simultaneously. The production of similar parts can be further increased by using two work coils and a change-over switch.

The illustration shows a lens grinding block being heated within the dome-shaped work coil. The heat generated in the metal block softens the pitch enabling the operator to remove the ground lenses and insert the next batch. The entire operation is completed in a few seconds.

Electronic Tube Generators—1 KW; 2½KW; 5 KW; 10 KW; 20 KW; 30 KW; 50 KW; 75 KW; 100 KW.
Spark Gap Converters 2 KW; 4 KW; 7½ KW; 15 KW; 30 KW.

WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.



All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 50

Presenting . . . Representing . . .

The appointment of L. J. Haney Associates, Kirkwood, Mo., as south central representatives has been announced by Punch Products Corporation, manufacturers of Unitized hole-punching and notching equipment.

Sheffield Corporation has announced the establishment of the Sheffield Western Sales Corporation, Culver City, Calif., as a direct sales branch.

Die Supply Products Co., Long Island City, N. Y., and Quad Tool and Die Supply Company, Merchantville, N. J., are now representing Porter Precision Products in their respective cities.

Engis Equipment Company, Chicago manufacturer of Hyprez diamond compound, announced recently the appointment of Machinists' Tool & Supply Co. as exclusive stocking distributor for Los Angeles and southern California.

The Stone Company, Inc., of Minneapolis, Minn., has been named to represent Wesson Company, handling the complete line of Wesson carbide cutting tools and Wessonmetal cemented carbides throughout Minnesota and western Wisconsin.

Wendt-Sonis Company of Hannibal, Mo., and Rogers, Ark., has been appointed as a sales outlet for Alsimag Ceramic Tips for metal cutting tools. Alsimag ceramics are made by the American Lava Corporation.

Machine Tool Sales Company, Division of Tool Supply & Engineering Company, now handles the sales of Taft-Peirce machine tools in the Dallas, Texas, area.

Techneering Sales, Inc., of Dayton, Ohio, is the newly-named representative in southwestern Ohio for George Scherr Optical Tools, Inc.

Abrasive Machine Methods Corporation of Cleveland has been appointed exclusive representative in northeastern Ohio for Buckeye Tools Corporation, handling drilling, fastening, abrasive and special tools and accessories in both air and high-frequency electric types.

WITH VERS-O-TOOL HEADS

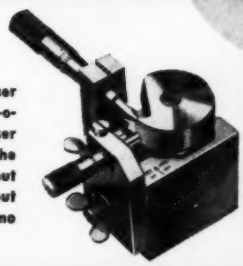
you get *PRODUCTION* advantages on any job requiring end-forming, turning, thread cutting

QUICK, SIMPLE CHANGE-OVER

Vers-o-tools provide for quick removal of threading chasers (or milling cutters) on their holding blocks—without disturbing head adjustment or set-up.

NO "CUT-AND-TRY" REQUIRED

Take the guess-work out of chaser grinding with the "Namco Vers-o-tool System": sharpen each chaser on its holding block, then check the grind on Namco micrometer gage; put the set back in the head without need for further adjustment—no "cut-and-try" required.



MANY REGRINDS PER SET

You can grind and regrind 270 usable degrees of Namco chaser circumference—one set cuts more threads than 10 sets of conventional chasers.

use the same Vers-O-Tool Head . . . change only cutters and blocks

THREADING

END-FORMING

END-TURNING

TURNING-THREADING

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Is your production barometer up?

You Get a

"RISING" PERCENTAGE WITH DPS POWER DRIVEN SCREWDRIVERS and SELECTIVE PARTS FEEDERS

Widely Adaptable to Individual Requirements

● Are you using DPS Power Equipment? If not, we urge that you get full details now . . . If you have a difficult problem, don't hesitate . . . Thirty years of experience with thousands of different applications . . . will enable us to cope with it and supply you with machines engineered to fit your needs. Progress demands DPS methods . . . Necessities in modern production where speed, economy and handling at minimum cost are so important . . . We can help you . . . Write today . . . Ask for catalog.

5 SCREWDRIVING MACHINES, Bench and Pedestal types. Model A pictured.

BOWL FEEDER, Vibratory type, to select and feed smaller, fragile parts.

BARREL FEEDER with stationary ring cover, for heavy-duty, large production runs.

BARREL FEEDER conventional type, for parts requiring critical selection.

DETROIT POWER SCREWDRIVER CO.

2827 W. FORT ST DETROIT 16, MICHIGAN.

CIRCLE INFORM-A-GRAM KEY NO. 52

Will You Be There?

Apr. 29 - May 1. Electrochemical Society, Inc. Spring Meeting. San Francisco.

●

Apr. 30-May 1. American Society of Mechanical Engineers. Conference on Nuclear Power Plants. Hotel William Penn, Pittsburgh, Pa.

●

Apr. 30 - May 2. Association of Iron & Steel Engineers. Annual Spring Conference. Lord Baltimore Hotel, Baltimore, Md.

●

May 3-5. American Institute of Mining and Metallurgical Engineers, Inc. Pacific Northwest Regional Conference. Olympic Hotel, Seattle, Wash.

●

May 4. College of Engineering, Ohio State University. Annual Conference for Engineers. Ohio Union, Columbus, Ohio.

●

May 7-11. American Welding Society. Spring Technical, National, Meeting, and Welding Show. Statler Hotel, Buffalo, N. Y.

●

May 9-11. Investment Casting Institute. Annual Spring Meeting. Hotel New Yorker, New York City.

●

May 10-11. Society for Advancement of Management, Chicago Production Control Section. Second Midwest Conference. Palmer House, Chicago.

●

May 14-17. Design Engineering Show and Conference. Convention Hall, Philadelphia, Pa.

●

May 20-23. American Supply & Machinery Manufacturers' Association, Inc. Annual Convention, Triple Industrial Supply Convention. Atlantic City, N. J.

●

May 20-23. Industrial Heating Equipment Association, Inc. Spring Meeting. The Homestead, Hot Springs, Va.

●

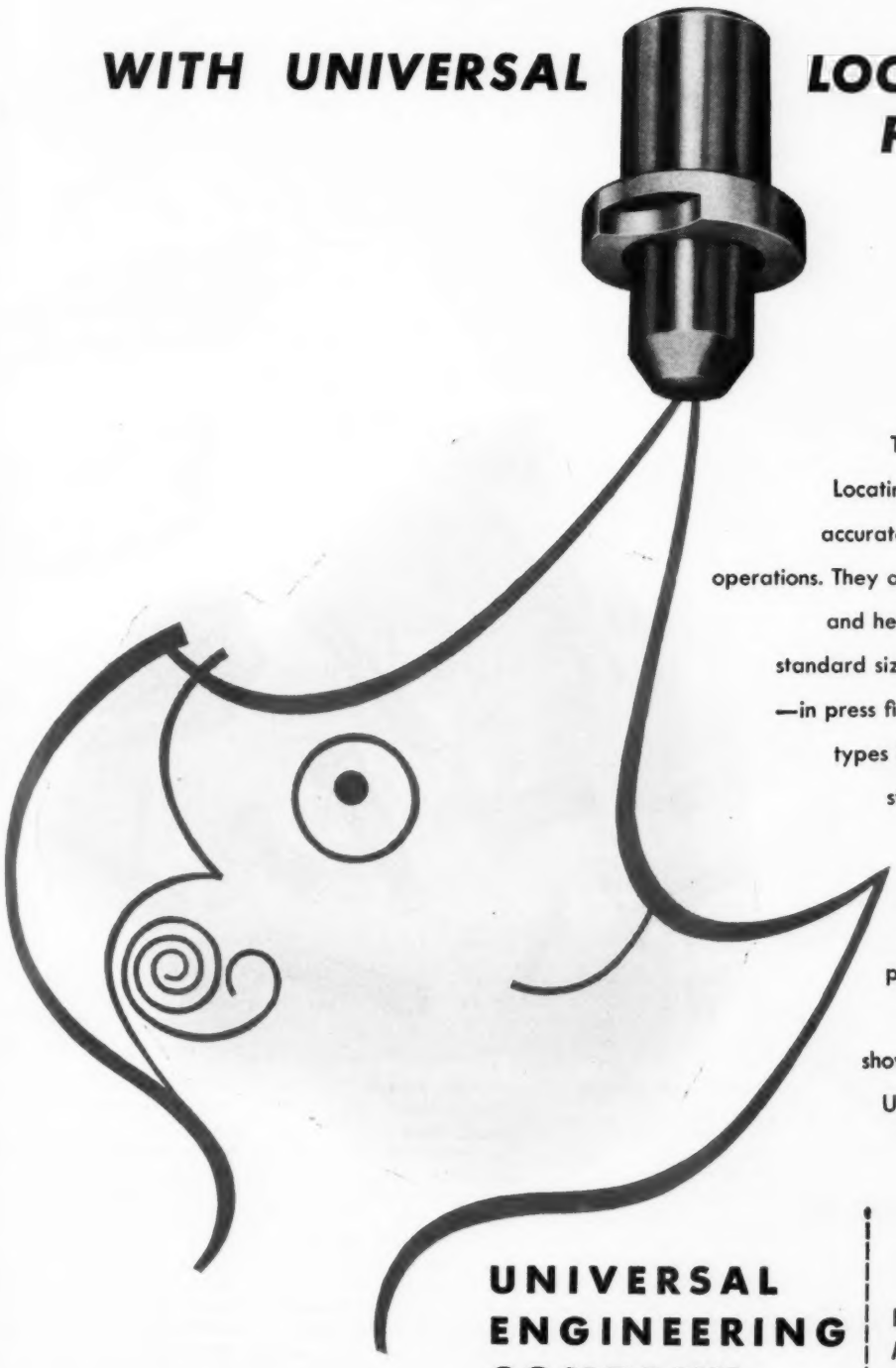
May 24-26. Armed Forces Communications and Electronics Association. Tenth National Convention. Boston, Mass.

●

May 28-30. National Fluid Power Association. Annual Spring Meeting. The Greenbrier, White Sulphur Springs, W. Va.

locate RIGHT ON THE NOSE!

WITH UNIVERSAL LOCATING PINS



The accuracy of Universal Locating Pins assures you quick, accurate alignment in production operations. They are hardened and ground and held to close tolerances. All standard sizes—of round or relieved —in press fit, threaded or lock screw types including rest buttons are stocked and available for immediate delivery at a fraction of the cost of ordinary tool-room pins. Write today for new 98 page catalog showing the complete line of Universal quality products.

UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 8, MICHIGAN

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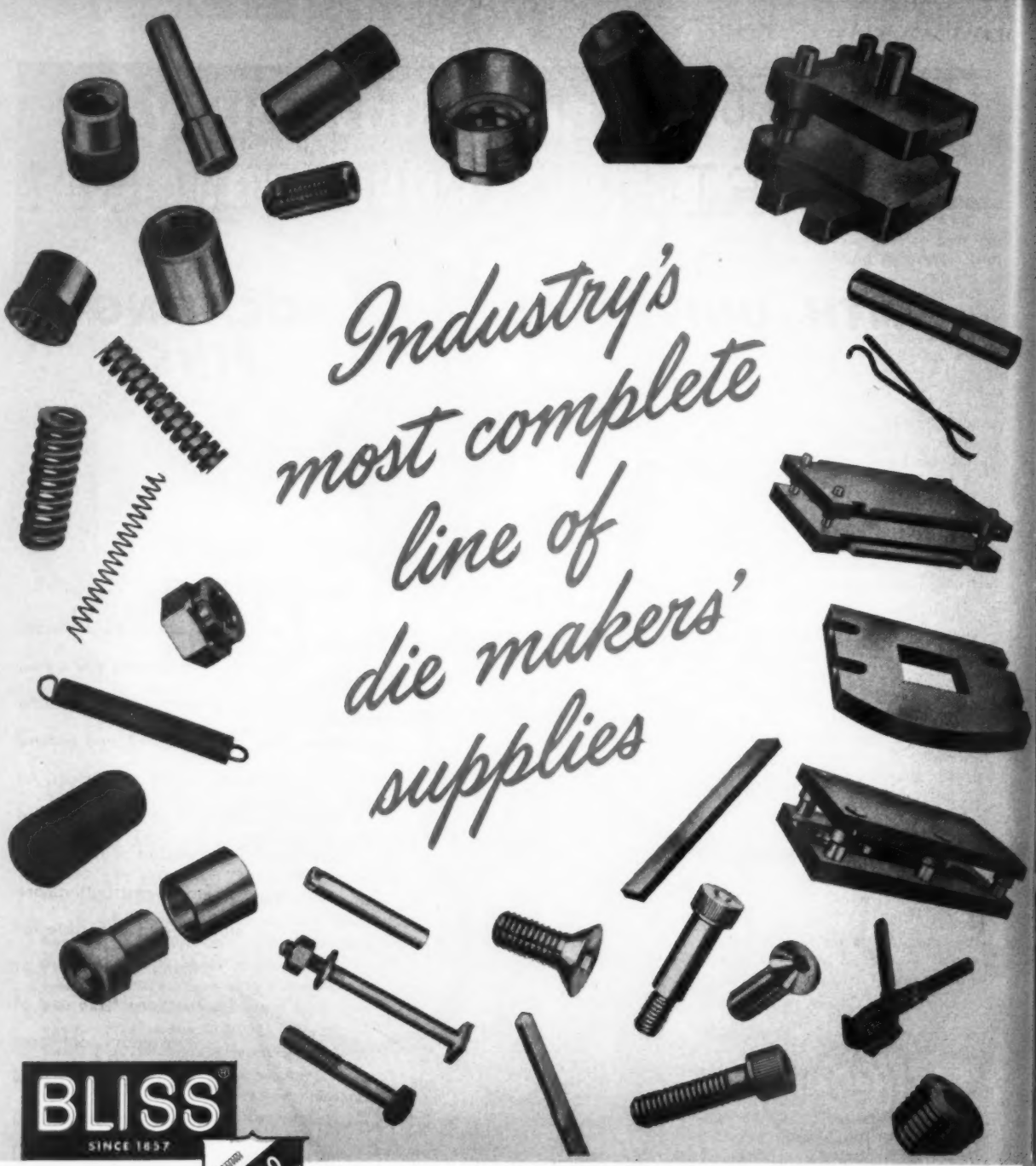

BLISS®
SINCE 1857

DIECO

E. W. BLISS COMPANY

DIE SUPPLY DIVISION

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Cleveland, Ohio

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Fidelity Tool Supply, Inc.
CEDAR RAPIDS, IOWA
Midland Supply, Inc.
CHARLOTTE, N. C.
Apex Machine Tool Supply, Inc.
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At Your SERVICE

Manufacturers in need of small precision tube and bar stock components can now obtain a complete service, including design, tooling, and production, from H & H Machine Co., Norristown, Pa. In the case of these parts, the firm will design and make the tooling to handle a wide variety of cold working and cold heading operations.

Crobalt, Inc., of Ann Arbor, Mich., now has a production service on shell-molded castings as an expansion of the company's regular casting activities. Ferrous and non-ferrous alloys can be handled there to produce many parts.

The Universal Match Corporation which previously had considerable experience in aluminum impact extrusions in its armament division, has expanded its activities in this field with the establishment of Impax, Inc. Impax will produce aluminum impact extrusions of high tensile and yield strength on any cylindrical, square, rectangular or symmetrical hollow part. With its processes the company can produce, often by fabrication in one piece, subassemblies which formerly required several component parts.

Major assistance in specialized tooling for aircraft manufacturers is one of the services of Hewitt & Faust, Inc., aircraft and electronic parts supplier in El Cajon, Calif. The jig boring facilities at the company make it one of the largest tooling sources available to manufacturers in the southwest.

Full-scale commercial production of impact extrusions for industry has been launched by General Dry Batteries, Inc., of Cleveland at its Memphis, Tenn., plant. The aircraft, appliance, automotive, electronic, and office equipment industries are now being served.

Super Alloy Forge, Inc. of Hamburg, Mich., makes a business of fabricating metals of the "rare" type without waste. The firm has the extracting equipment necessary to form these metals or their alloys, either hot or cold, and is equipped to handle production requirements as well as experimental work in developing effective fabricating methods.

Specialized manufacturing facilities for the fabrication of pressure vessels, high pressure piping, and unusual weldments can be found at the Foster Wheeler Corporation's four plants. The company's offices are in New York City.

WITH MAY-FRAN

STANDARD COMPONENTS

Through standardization, MAY-FRAN now makes it possible to assemble mass produced components into virtually any type of conveyor to handle a wide range of products or materials.

This program is cutting costs for manufacturers because . . . it means they can dis-assemble their conveyors for use in other plant locations . . . it means conveyors can be modified in almost any way at minimum cost.

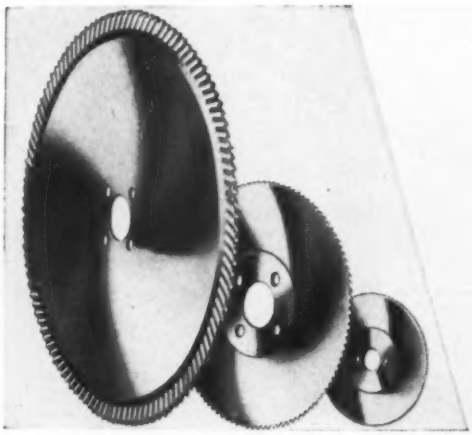
Pre-fabricated sections are available rapidly and inexpensively. Straight sections . . . concave or convex sections . . . take-up charge and discharge-end sections can be furnished to meet specific requirements of belt width as well as load bearing and volume capacities.

MAY-FRAN ENGINEERING, INC.
1726 Clarkstone Rd., Cleveland 12, Ohio

Write today for complete information.

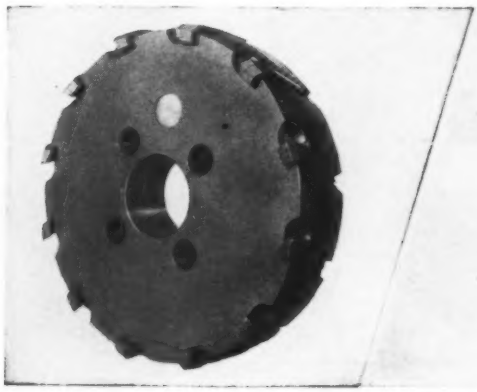
CIRCLE INFORM-A-GRAM KEY NO. 55

Using is Saving with These PROVEN Products made by MOTCH & MERRYWEATHER



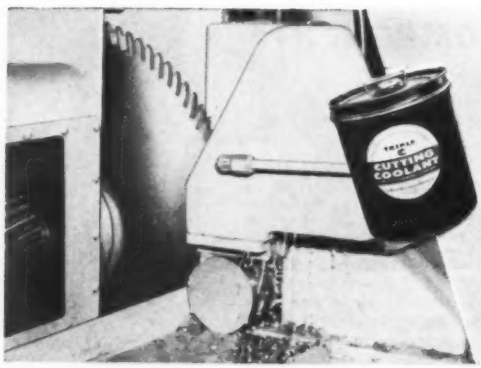
M & M Triple-Chip Saw Blades Save Waste in Metal Sawing

Complete line — segmental and solid — cut-off up to 108" dia., slitting down to 3" — for any machinable material, ferrous or non-ferrous, any size, any shape, any thickness. Less tooth strain, longer blade life, substantial savings in time and costs.



KROSLOK Milling Cutters Save Time in Precision Milling

Kroslok Face Milling Cutters and Shell End Mills cut any machinable material. Simplest design; only three members—body, blade, wedge. Serrations in body mate with cross serrations in blade. A profit-showing aid to accurate production milling.



Three Triple C Products Save Trouble in Tool Care

Triple C Grinding Coolant, Cutting Coolant and Machine Cleaner are Cool, Clear, Clean. Anti-rust, non-greasy, smokeless, odorless, foamless, non-flammable, non-clogging, safe for operators. A notable contribution to tool maintenance.

THE MOTCH & MERRYWEATHER MACHINERY CO.

Cutting Tool Manufacturing Division

Stocking Dealers in All Principal Industrial Centers

1250 EAST 222nd STREET, CLEVELAND 17, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 56

"Commendable Comments"

"Today, we are only duplicating what is being done by hand. As engineers design more and more for automation, we will see a rapid acceleration of progress. The television industry has made a start in redesigning the components of a receiving set to conform to automated production. Other industries are shifting and that means the advance of automation is here."

—By Ralph E. Cross, executive vice president, The Cross Company, Detroit, Michigan.

"No other American enterprise is so deeply and at the same time so variously involved in automation as ours. Since the emphasis of automation is on electrical control, we will have an increasingly important part to play."

—By Gwilym A. Price, chairman and president of Westinghouse Electric Corporation, at the Edison Electric Institute Sales Meeting, Chicago.

"In 1941 and 1949 it took an average worker 31 weeks of his pay to buy a Ford. In 1956, only 26 weeks' pay are needed."

—By R. J. Eggert, Ford Motor Company's marketing research director, at a joint meeting of the Atlanta (Ga.) Ad Club and the Georgia Chapter of the American Marketing Association.

"So it is obvious that while we will continue to need an elite corps of scientists to devise the technology which accounts for industrial progress, we also will need people with enough scientific education to understand how to operate the new machines and processes."

—By Samuel Leuher, vice president of the du Pont Company, at the convention of the National Science Teachers Association in Washington.

"The Electrical Industry is expecting to build as much equipment in the next 10 years as it has during its entire 75-year history."

—A prediction by Ralph J. Cordiner, President of General Electric Company, in STEEL HORIZONS Magazine.

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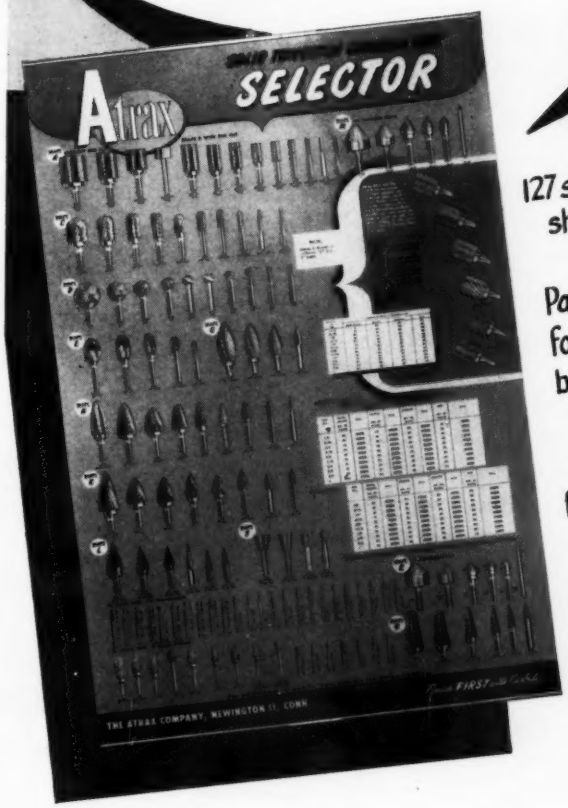
FREE ATRAX SOLID CARBIDE
BUR SELECTOR CHART
Today!



127 solid carbide burs shown full size!

Packed with tips for better bur performance!

Bur speed chart for all materials!

Shows cuts available: STANDARD-FINE-COARSE-EXTRA COARSE-DIAMOND-CHIP BREAKER!

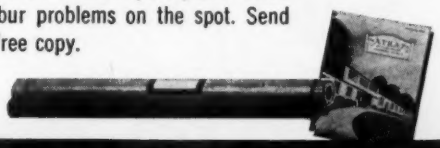
Illustrates virtually all standard sizes and shapes!

Colorful, easily read-18½"×27½" with permanent plastic coating for years of use!

All the information for ordering the right solid carbide bur for any job!

Mailed in rigid tube ...and it's FREE!

Hang this permanent chart in your plant—solve solid carbide bur problems on the spot. Send now for your free copy.



Atrax
THE ATRAX COMPANY
Newington 11, Conn.

CIRCLE INFORM-A-GRAM KEY NO. 57

You Get These Exclusive Safety and Handling Features

with all

SUPERIOR DIE SETS

Large Sets No Longer Need Be Blocked . . . Small Sets Can Be Lifted Without Sliding.

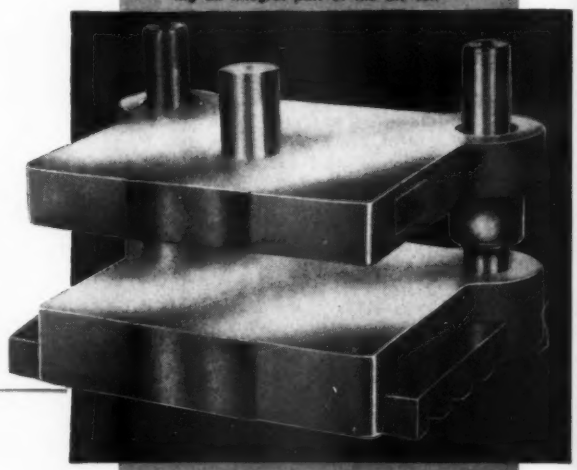
Three features exclusive with SUPERIOR DIE SETS permit rapid assembly, disassembly and overall handling of large and small die sets. In addition they provide safety insurance . . . protection for the skilled hands of die makers and handlers . . . protection also against the ruining of costly dies in handling, or even damaging of valuable press equipment. Write for FREE 24 page Catalog on Superior Die Sets and Supplies.

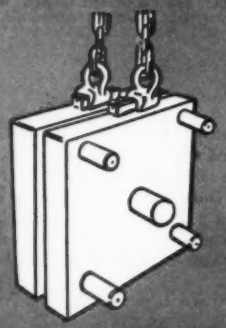
SAFETY FLANGE

protects fingers by providing roomy gripping space on either side of the die shoe.

LOCK-JAW LIFTING DEVICE

removes the danger of handling large die sets. Heavy steel components of this device are welded in place forming an integral part of the die set.





E-Z LIFT SLING CHAIN

is especially designed to fit the flanges of the die sets. Male jaws attached to the sling fit quickly into place for immediate lifting. There is no need for screw clamps, eye bolts, or lifting lugs.

For Fast Local Service Call these Expert Superior Representatives

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2754 S. 19th ST., MILWAUKEE, WIS.

CIRCLE INFORM-A-GRAM KEY NO. 58

FILMS TO SEE

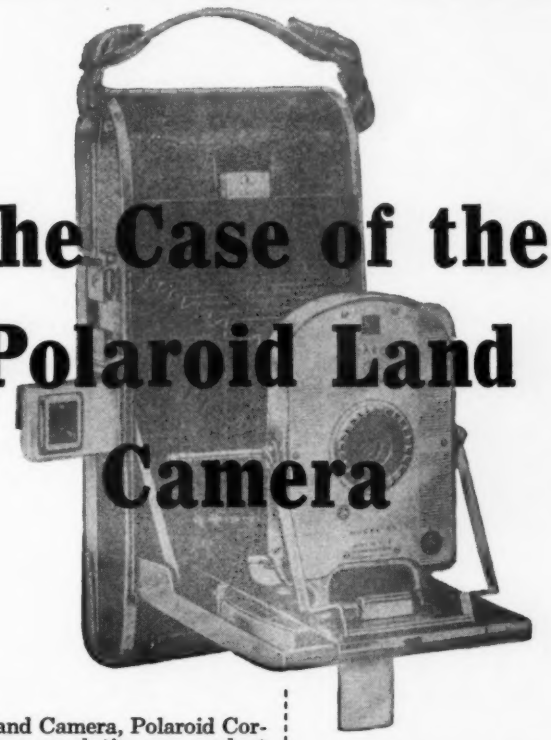
"Tools of Abundance" deals with the basic functions of various members of America's "production team"—design engineers, process engineers, tool engineers, tool grinders, machine operators, etc. The film takes a single part of a new product and shows how each team member contributed to solving the problems connected with its production. The 28-min sound and color movie is made available at no cost from Wesson Co., 1220 Woodward Heights Blvd., Ferndale 20, Mich.

A sound-color movie, "A Modern Fable," based on the company's line of automatic transfer feed presses, has been completed by Clearing Machine Corp. Animations and direct camera work are used to explain in detail the operation of a transfer feed press. This movie should prove to be highly informative to engineers, production men, and others in the metalforming industry. To obtain the movie, write to U. S. Industries, Inc., Chicago Regional Advt. Dept., 6201 W. 63rd St., Chicago 38.

Aluminum, brass, and steel extrusion processes are described in "Pressure on Extrusion Production," available on a free-loan basis from Lake Erie Engineering Corp., Box 68, Kenmore Station, Buffalo 17. Particular emphasis and explanation are given to the interaction of press components during the extrusion cycle for aluminum. Loading, sealing, extruding, stripping, and shearing are visualized for the various types of presses. Included are scenes demonstrating the technique developed by Ugine-Sejournet for the extrusion of hot steel using glass as a lubricant.

"Zinc Controls Corrosion" tells how zinc in its role of "protector" controls corrosion to lengthen life, and to minimize maintenance and replacement costs. In addition, the movie presents a demonstration of the general mechanism of corrosion. Methods for coating steel stock or products with zinc are explained and the fields of usefulness for zinc-coated parts are surveyed. Also described are the new continuous galvanizing lines and the hot dip galvanizing of large structural parts. The film is loaned free of charge by The American Zinc Institute, Inc., 60 E. 42nd St., New York 17.

STAMPINGS IN SMALL LOTS



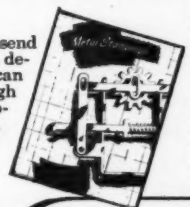
The Case of the Polaroid Land Camera

In the first Land Camera, Polaroid Corporation had a revolutionary product that took a picture, and 60 seconds later turned out a finished print. Before tooling up for mass production, it had to answer two questions. What is the sales potential? And, will the camera operate perfectly in the hands of the public? Polaroid decided to test the market with a pilot run of 1,000 cameras.

The product engineer, well aware of the value and low cost of short run stampings for such pilot runs, came to Dayton Rogers Manufacturing Company for help. As a result, all die-cut stampings for the first thousand Land Cameras were supplied by Dayton Rogers.

Polaroid was able to test its now famous camera and make changes for a fraction of the price of conventional tooling.

FREE . . . We will gladly send you a booklet describing in detail how Dayton Rogers can take you economically through periods of product development and product change. Please write for it on your letterhead.



LOW-COST WAY TO TEST NEW PRODUCTS

Dayton Rogers Manufacturing Company produces metal stampings in small lots with rigid accuracy and remarkable economy. *The short-run tools cost you no more than 15% to 20% of conventional type tooling.* Here is truly the low-cost way to develop new products and to make improvements or changes in existing products.

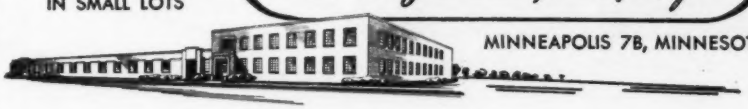
This method was originated by Dayton Rogers more than 30 years ago. It is based on a patented process, special machinery and craftsmen specially trained as short run tool makers. No other method equals it. All over the country manufacturers are using Dayton Rogers metal stampings for product research and experimental runs.

Factory-trained representatives in all principal industrial areas

NATIONAL HEADQUARTERS FOR METAL STAMPINGS IN SMALL LOTS

DAYTON ROGERS Manufacturing Company

MINNEAPOLIS 7B, MINNESOTA



CIRCLE INFORM-A-GRAM KEY NO. 59

Bausch & Lomb
BENCH COMPARATOR

So easy, inexperienced help become

SKILLED INSPECTORS

in a single afternoon!

Speed production of precision parts with this simple, time-saving *optical* inspection tool. No complex set-ups, no holding fixtures needed for most work. With exclusive under-stage illumination you simply lay work on table—see accurately magnified silhouette at comfortable eye level. Performs equivalent of several different mechanical inspections in one quick, easy visual check. Instantly reveals costly production errors. Reads to .0001" with optional micrometer stage.

SEE FOR YOURSELF IN ON-THE-JOB DEMONSTRATION!

For full information and obligation-free demonstration, call your local Do-ALL Sales Service Store, or write: The Do-ALL Company, 254 N. Laurel, Des Plaines, Illinois . . . exclusive sales and distribution agents.

BAUSCH & LOMB
SINCE B&L 1853

Quality Control
INSTRUMENTS

CIRCLE INFORM-A-GRAM KEY NO. 60

By-line Briefs:

In addition to a very busy schedule as Manager of Q-C at Warner Electric Brake & Clutch Co., FAY CARLSON is frequent Q-C conference speaker and a teacher at Vocational Training Programs at both Rockford and Beloit. A Junior Past President of the Rockford Section, ASQC, he answers the question "Do You Have a Unified Q-C Program?" in this issue.

HARMON S. BAYER and RAY F. ENGELGAU started "Selling Q-C to Management" in the last issue; Part II is presented this month. Mr. Bayer has been a Q-C Consultant since 1952; immediately before that he was with Ford in Dearborn. He also teaches courses in Q-C and management at several universities. Mr. Engelgau, with 42 years in Industry, started out as a tool and die maker. In 27 years at Mueller Brass he has worked also in the time study, production, inspection, and Q-C departments. He was appointed Director of Q-C a year ago.

Ohio State claims WENDELL H. ABBOTT as an alumnus and the American Society for Quality Control has named him a Fellow. Author of "Which Standard Deviation?" in this issue, Mr. Abbott has been Supervisor of the Statistical Section of GE's Lamp Division at Nela Park since 1943 and is author of numerous articles on statistics and Q-C.

A Wayne University graduate with a master's degree in radio broadcasting, RALPH B. NOTTINGHAM was an ordnance engineer with the Naval Ordnance Labs before joining Brush Electronics in 1945. Since that time he has headed various technical departments there. He's author of this issue's "How Do We Measure Machine Capability?"

A senior member of both ASQC and ASTE, S. E. PETERS, author of this issue's article on acceptance sampling has been Chief Inspector at the Dumore Company for 22 years.

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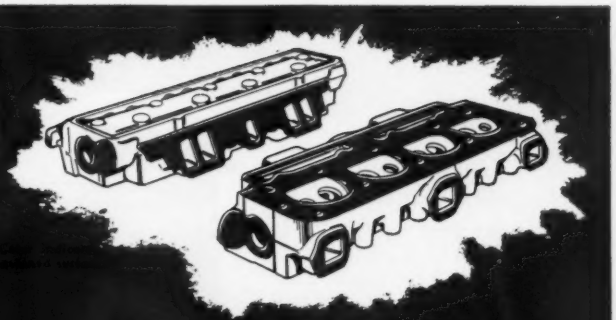
CUSTOMER SPECIFIED



KEARNEY & TRECKER MILWAUKEE® DESIGNED

Kearney & Trecker built this 12-Station Automatic Transfer machine which rough and finish mills the head gasket surfaces, mills intake and exhaust port surfaces and both ends, and drills, counterdrills and reams two holes on each of two cylinder heads for V-8 engines. Machine's production rate is 100 pieces per hour.

The two cylinder heads progress automatically through the machine side by side, each on separate transfer rails. Transferring, locating, clamping, lubrication and chip disposal are all automatic.

For more information on machine illustrated, ask for Data Sheet No. 1080. A new bulletin, SMD-56, which describes many of our outstanding designs, is also yours for the asking.

Production efficiency starts with Kearney & Trecker Milwaukee machine tools

This typical example reduced costs and meant higher production for the buyer. Kearney & Trecker's Special Machinery Division's 50 years' experience in machine design and manufacture can mean considerable savings to you.

Take advantage of our abilities. They can pay off in profits for you. See or write your Kearney & Trecker Special Machinery Division representative. He will be pleased to give you all the details on this production machine. Contact him today!

Special Machinery Division

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Designers and Builders of Precision and Production Machine Tools Since 1898

CIRCLE INFORM-A-GRAM KEY NO. 61

IMPORTANT NOTICE!

Every drum and bag of CIBA *Epoxy* RESINS carries this exclusive double check

To all users of this basic and widely used class of resins, the development of which was pioneered by CIBA researchers, rigid **manufacturing** and **applicational** control of Araldite Epoxy Resins *at the source of their production,* means utmost assurance of quality and uniformity. For further information on how CIBA Epoxies may lead to product improvement and new product development for you, write . . .

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CIBA
ARALDITE® Epoxies

CIRCLE INFORM-A-GRAM KEY NO. 62

. . . By-Line Briefs from Page 60

EDWARD C. VARNUM spent 10 years teaching after receiving his degrees from the University of Michigan before joining the Electrical Engineering Labs at Barber-Colman. Four years ago he was named to direct the use of Operations Research there. A mathematician by trade, he is past head of the Rockford Chapter of ASQC and a past national director of ASQC, a member of Phi Beta Kappa and numerous other technical groups.

One of the founders of Boice Gages, Inc., LOYD BIGELOW now serves as the firm's technical consultant. During the development of the gages he writes about, he visited the majority of large diameter gage users in this country, consulting with tool and gage engineers and quality control and production men.

WILLIAM C. SEITZ and JACK H. POWERS, co-authors of "Quality Control of Cemented Carbides," each spent 19 years with Firth-Sterling, Inc., before joining Firth-Loach Metals, Inc., two years ago. Both men have wide experience in the field of powder metallurgy.

Design Expert New T&P Associate Editor

Newly appointed associate editor of TOOLING & PRODUCTION, William E. Hoffman brings to the expanding needs of the publication an extensive background in mechanical engineering and tool and machine design.

Mr. Hoffman, 37, studied at Muskingum College, Western Reserve University, Goodyear University, and Cleveland-Marshall Law School. Since 1941 he has been engaged primarily in design activity, with most of this experience being on a supervisory level.

Not unknown to many readers of this magazine, Mr. Hoffman authored two feature articles in our 1954 series on "Air Power for Metalworking."

Tinker...to Evers...to Chance

The close co-ordination of three outstanding players made this the most famous double-play combination in baseball: cat-quick Joe Tinker at shortstop, pivot man Johnny Evers at second base, and at first base the sure-handed Frank Chance. All three men indispensable for fast, smooth ball handling.

Producer...to Industrial Distributor ...to YOU, the Industrial Consumer

All three members of our industrial combination are important for the fast production and smooth flow of goods. The Industrial Distributor is the "pivot man." He receives from the Producer the equipment and supplies you need and relays them to you unerringly — *when* and *where* you want them. Your Industrial Distributor is a specialist who saves you time and money by performing many functions for you. For example:

He cuts your operating costs by stocking the multitude of items — both seldom-used and those you need every day — that would otherwise tie up your capital and incur handling, storage and insurance expense.

He simplifies your purchasing problems by keeping you informed about new products, and by knowing where to find scarce items for you.

He helps keep your plant running smoothly by rushing badly needed items to you more quickly than you could usually obtain them direct, and by passing on to you sound product knowledge and technical advice.

He reduces the cost of the items you buy because he can distribute more efficiently than producers could if they dealt with all their customers direct. Thus product costs are lowered, and the savings passed on to you.

He is a single, convenient source for all your industrial needs. Imagine the time-consuming complication if you had to deal with each of your suppliers individually!

The Industrial Distributor saves you more than 10% on the cost of supplies and equipment. We're glad he's on our industrial "team." We of Nicholson File Company have marketed exclusively through distributors for many years.* *Estimate by *Industrial Distribution* magazine

NICHOLSON FILE COMPANY
Providence, Rhode Island
World's foremost manufacturer of A FILE FOR EVERY PURPOSE

CIRCLE INFORM-A-GRAM KEY NO. 63

VK

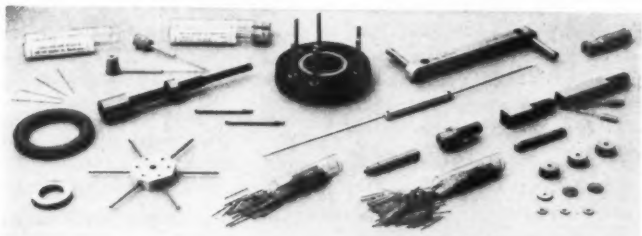
USE OUR SKILLS on YOUR LAPPING PROBLEMS

If that tough production part has Gage Characteristics, try the Van Keuren Precision Lapping Service--

The Van Keuren Co. laps optical flats to an accuracy .000001", gage blocks to .000004", plug gages to .000010". Your job may not be this precise, but it's a safe bet that VK skills can save you money on lapping problems involving size, flatness, parallelism or fine surface finish. If that tough production part has at least one gage characteristic, ask for a quotation from VK.

We lap flat and cylindrical work in both metals and non-metals. Sealing rings and plates for pumps and pressure devices, precision pins, spacers, pistons, punches, carbide pivots, valve parts, instrument components and parts for testing inspection equipment, are among the customer items handled economically here in our plant.

If you require lapped or polished surface finishes in the order of .5 to 5.0 RMS, or dimensional tolerances from .000001" to .0001", The Van Keuren Co. can probably help on the problem. The "rule of thumb", as suggested above, is "at least one gage characteristic."



Send for a copy of the new, 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:

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37th YEAR

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171 WALTHAM STREET, WATERTOWN, MASS.

Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . . Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . . Carbide Plug Gages . . . Laps and Surface Plates . . . Precision Lapping Service.

CIRCLE INFORM-A-GRAM KEY NO. 44

by Erwin K. Taylor, Ph. D.
President
PERSONNEL RESEARCH AND DEVELOPMENT CORP.
Cleveland 20, Ohio

Ed.—Because of favorable reader response to our previously-published articles on human relations, we have invited Dr. Taylor—prominent lecturer, educator, journalist and consultant—to initiate this monthly column as a help to our readers in dealing with people — employees, associates, bosses. Here's Dr. Taylor.

LET ME INTRODUCE MYSELF. I am an **industrial** psychologist. Don't let the word scare you. I can't read minds and I don't know any more about your dreams than you do. I am **not** a psychiatrist. A psychiatrist is a medical doctor. He received the same training and went through the same kind of internship as your family physician. After that he spent several years in a mental hospital where he concerned himself with the care and treatment of people with serious enough mental disorders to cause them to be hospitalized.

Most of all I am **not** a psychoanalyst. I know only a little about the works of Sigmund Freud and disagree with most of what I know. I am not even a **clinical** psychologist who is also trained to treat the mentally ill in cases where there is no medical basis for the illness.

I am an **industrial** psychologist.

As an industrial psychologist my training and experience has been aimed at the study of normal, healthy people and their relationships to the way in which they earn a living. I have been trained to help people find the kind of job in which they are most likely to be happy and successful. To help business and industry fill jobs with people who will stay on them and do them well, I help training departments design programs and then help them to find out how good those programs are. I help management to measure the attitudes of employees and then analyze those attitudes so I can suggest policies that will improve them. I devise techniques to help foremen do a bet-

. . . Continued on Next Page

TECHNICAL BOOKS

DIE DESIGNING AND ESTIMATING ***Fourth Edition***
368 pages, 26 chapters, and over 400 illustrations, drawings, charts and graphs. Extensively revised and enlarged plus a special section of 165 Practical Points in Die Design and Construction. Completely indexed. IMMEDIATE DELIVERY. $7.50 per copy

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28 pages of KNOW-HOW on the blanking, punching, perforating, and bending, forming, deep drawing and spinning of the stainless steels. $1.00 per copy

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36 pages on the working of stainless — including drilling, tapping, threading, reaming, skiving, milling, broaching and shaving, plus heating and quenching procedures. $1.50 per copy

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Open account shipments on company purchase orders. Otherwise check with order, please. No C.O.D.'s please. *Ohio customers add 3% sales tax.

Check your template drill bushings against PEM's "score"

* If you don't get the same answers, you may be able to *buy your bushings out of template assembly savings.* Try switching to PEM Self-Clinching Drill Bushings.

QUESTIONS	PEM ANSWERS	
Do your present bushings:	***yes***	***no***
Permit use of thin gauge template metal? (One-third conventional thickness)	✓	
Offer one-hole fastening in template?	✓	
Require processing multiple holes for each bushing?		✓
Are they self-clinching compression mounted?	✓	
Do they require riveting or welding?		✓
Are they round?	✓	
Do they require indexing?		✓
Are they irregular shaped?		✓
Do they require nesting?		✓
Can they "cock" during installation?		✓
Do they assure true alignment, automatically?	✓	
Do they assure true center distances, automatically?	✓	
Are they simple one-piece units?	✓	
Are they assemblies with fastening straps?		✓
Do they permit location in closest proximity?	✓	
Do they have high torque and pullout resistance?	✓	
Do they require special machinery for assembly?		✓
Is specially skilled labor required?		✓
Are bushings hardened steel?	✓	
Are holes burnished to close tolerances?	✓	

*Write for literature and samples for trial.

PENN ENGINEERING & MANUFACTURING CORP.
DOYLESTOWN, PENNSYLVANIA

PEM

CIRCLE INFORM-A-GRAM KEY NO. 66

ter, less biased job of measuring the performance of their workers.

In doing all these things I get around to lots of industries, talk to many personnel men, and read an unending stream of articles — good, bad, and indifferent — in technical journals and management magazines. Because I do all these things I pick up a lot of dope about people in relation to their work. I pick up some good ideas and some that are screwy.

The publishers of TOOLING & PRODUCTION realize that in any business or industry, big or small, light or heavy, people are important. That is why they have provided this space and invited me to pass on to you a summary of what's going on in the personnel area.

So far, I have talked mainly about myself. That won't happen again. In future columns we'll discuss such problems as "How to Pick Better Foremen", "What Good Are Intelligence Tests?", "Is Morale Important?", "What Is Human Relations Training?", and such other topics as you may find helpful in your relations with the people with whom you work.

Competition Open For Design Award

Entries are now being accepted for the sixth annual Design Award Program of the Industrial Designers' Institute.

The program is aimed at giving unbiased professional recognition to industrial designers for noteworthy and fresh approach to design and function, combined with practical use of appropriate materials. Designs submitted as evidence for awards must be mass produced and nationally distributed and every designer or team of designers in the industrial design field is eligible to compete.

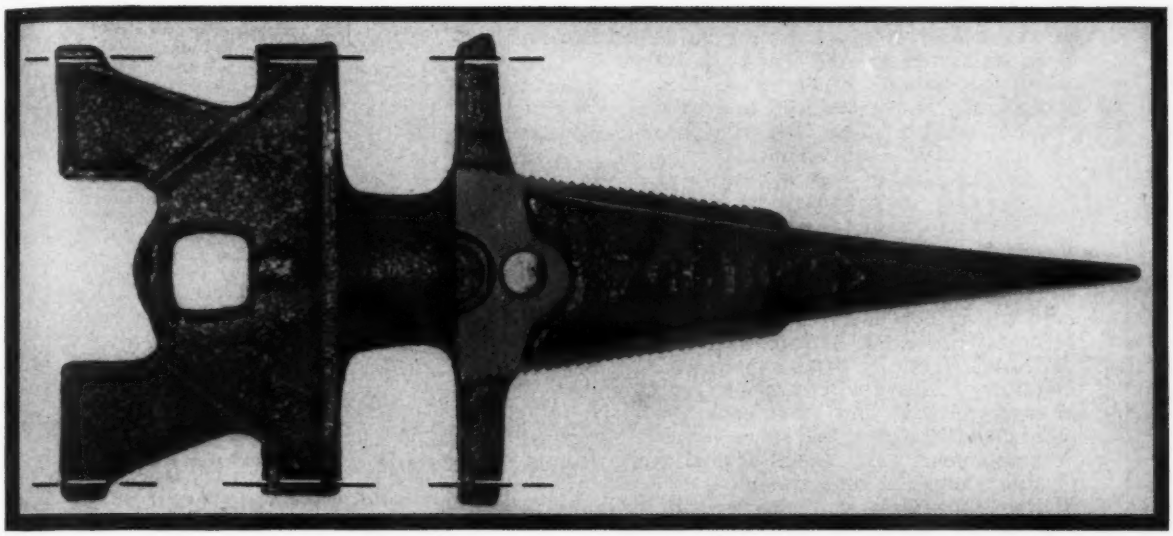
IDI defines mass production, as related to the program, in these terms: "appropriate quantity production in any given field; for instance, six locomotives, or 100,000 radios."

Designs submitted to the award committee must have been in production in 1955-1956, and must be attributed to an individual designer, or team, working either on the manufacturer's staff or independently.

Full details of the IDI program are in the submission forms, available from Walter C. Granville, committee chairman, at Container Corporation of America, 38 S. Dearborn St., Chicago. The forms must be postmarked by May 19.

On this tough mower
blade-guard casting . . .

Carbide-equipped shear die increased production 800%



Mower blade-guard castings are sheared at these 6 places simultaneously. Steel die sheared only 12,000 castings between grinds. Carboloy carbide-equipped die sheared more than eight times as many per grind.

So tough is this casting that the best steel shear die the Oliver Corporation could buy, required regrinding every 12,000 pieces. But when the switch was made to a die equipped with Carboloy® cemented carbide, production jumped to over 100,000 pieces per grind – an increase of more than 800%!

Where the steel trim block needed sharpening every day, the carbide block lasts more than eight days between grinds – cutting production and maintenance costs every minute of that time.

The benefits Oliver Corporation got from their carbide die – more production, fewer rejects, less downtime – are typical of the savings Carboloy cemented carbides are bringing die users all across the country.

These drawing, forming, blanking, and piercing dies have proved themselves in hundreds of cost-conscious plants . . . outlasting steel dies by as much as 50 to 1.

So, no matter what your job – large or small, simple or complex – it will pay you or your die-maker to check into the advantages of Carboloy carbide-equipped dies. For more information, or to arrange for a Carboloy Die Engineer to call at your plant, mail this coupon today.

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CIRCLE INFORM-A-GRAM KEY NO. 67

MANUFACTURING MEMOS

Standardize Diamond Tool Shanks . . .

● Details on a proposal to standardize diamond tool shanks were presented by Martin Hoerer in a paper read at the Diamond Symposium at the March ASTE Tool Show in Chicago. The proposal climaxes a 3-year research program called Project B-67, sponsored by ASTE and the Industrial Diamond Association. It is proposed that 142 straight tool shanks can be reduced to 7 by standardizing the dimensions. The IDA Handbook now lists 188 different size tool shanks.

Research Section . . .

● Metallurgical problems in the atomic energy field will be concentrated on at a research section being established at Armour Research Foundation of Illinois Institute of Technology. The reactor metallurgy section will engage in the development of uranium base and other core alloys, fuel-element cladding alloys, and special reactor materials or components; and metallurgical compatibility of fuel elements, core and clad. Dr. Donald J. McPherson will be acting supervisor and Ray J. Van Thyne, assistant supervisor.

Receives Honors . . .

● Dr. M. Eugene Merchant, assistant director of research at Cincinnati Milling Machine Co., has been appointed by the National Advisory Committee for Aeronautics to serve on the sub-committee on lubrication and wear. Dr. Merchant's second honor comes from France. He has become a member of the International Institution for Production Engineering Research.

● The Lincoln Electric Co. has announced its reentry into the electric motor field with the introduction of a line of "Linc-Weld" motors. The motors have a thermo-setting plastic insulation which is molded into and around the stator windings.

● The 50th Anniversary of electric steel-making in America was marked on April 5. The use of the electric arc melting furnace was introduced at Syracuse, N. Y., by the Halcomb Steel Co. which afterward became a part of Crucible Steel Co. of America.

A revolution in electrical equipment is seen through the use of aluminum wire. Aluminium Ltd. Sales, Inc., U. S. distributing subsidiary of Aluminium Ltd., revealed that its metallurgists have developed a new process of anodizing aluminum wire with alternating current giving it a ductile oxide coating which becomes an electrical insulation. Electrical equipment wound with the light, heat-resistant aluminum wire can be made smaller and cheaper and can run hotter.

◆

Production Tool Corp. has purchased Kuma Tool Co., Chicago manufacturer of precision tools and equipment. Production Tool is engaged in the contract manufacture of heavy machine tools, assemblies, and sub-assemblies.

◆

Kingston-Conley, Inc., producer of electric motors from 1/3 to 5 hp and other rotating electric apparatus, has been acquired by The Ohio Electric Mfg. Co. Ohio Electric makes electro magnets and control equipment, special machinery, and electric motors up to 1/3 hp.

◆

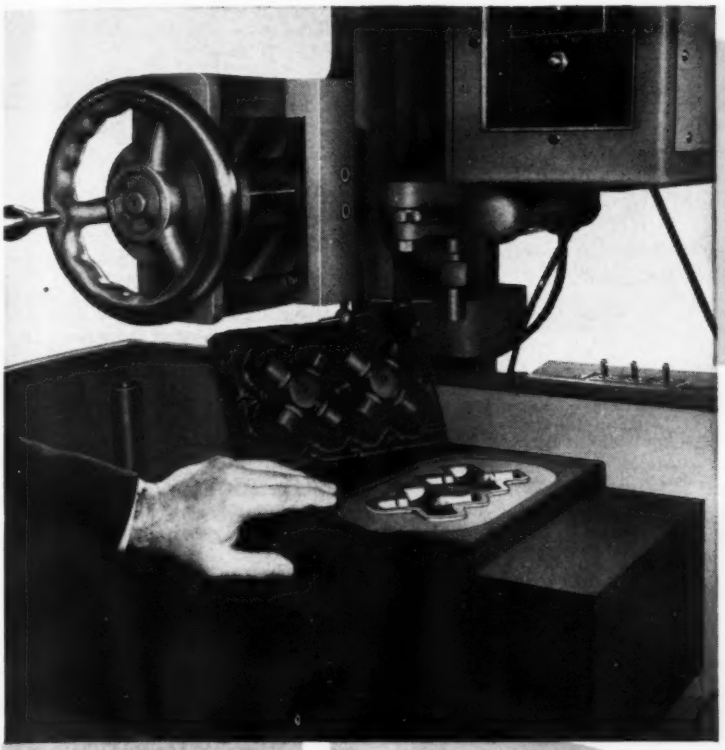
R. G. Haskins Co. has bought the N. A. Strand Division of Franklin Balmar Corp. Haskins is a leading producer of flexible shaft grinding, polishing, and capping equipment. E. P. Grismer will be general manager of N. A. Strand Flexible Shaft, Inc., the newly acquired subsidiary.

◆

Davis Boring Tool Division of Giddings & Lewis Machine Tool Co. has acquired the complete product line of Kelly Reamer Co. All inventory of Kelly tools will be moved to the Davis plant in Fond du Lac, Wis., where operations will be centralized and all tool stocks maintained.

◆

The second step in the expansion program of Holo-Krome Screw Corp. was realized with the completion of a new research and development division on the grounds of the West Hartford factory. This division will develop new techniques and methods for the forging of metals, permitting the manufacture of products not formerly forgeable, and machinery for secondary operations in the processing of various metals.



Electrical Discharge Machining

saved $448 sinking this forging die using BRASS electrodes

Conventional Method

Mill Cavity (Man and Machine)	56 hours
Hand Finish (Experienced die sinker)	52 hours
TOTAL	108 hours

ELOX method

Forge Electrode (Man and machine)	2 hours
Set up and change electrodes (man and machine)	8 hours
Machine hours only (no operator required)	32 hours
Hand finish after E.D.M.	2 hours
TOTAL	44 hours

Saved: 64 hours at $7 per hour

additional EDM advantages in forge die machining:

- Dies are fully heat treated prior to machining thus eliminating possible distortion.
- Resizing forging dies after washout can be done within two hours.
- Inherent workhardening values are retained in the dies since no additional re-heat treating is necessary.
- Actual die life is increased.
- Many forge die alloys are self-polishing after EDM.

This machining application is one of many time and material saving jobs being turned out by the standard Elox M-500 Electronic Machine Tool. See EDM in operation at Elox Demonstration Centers.

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CIRCLE INFORM-A-GRAM KEY NO. 69

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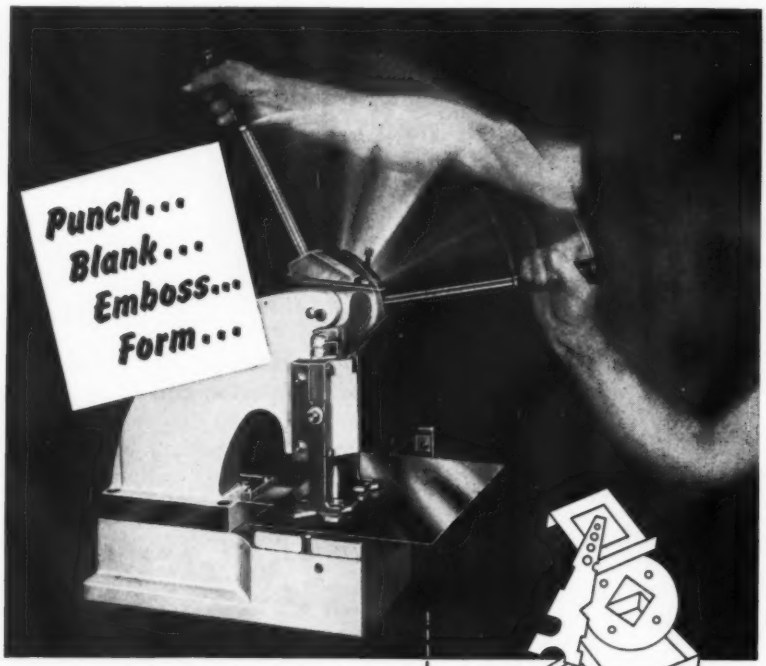
DEPARTMENTS

PUBLICATION PREVIEWS 142
Capsule description of current literature. Bulletins, brochures, catalogues and circulars — You name it.

SHOP AIDS 192
Need help in any aspect of modern metalworking? See this section for materials and design aids, inspection and production techniques.

PROGRESS ON PARADE 194
Check this carefully. It can bring new efficiency to your operation. The newest in machines, tools, and accessories.



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CIRCLE INFORM-A-GRAM KEY NO. 70

EDITORIAL: Quality Control in Kit Form 73

— FEATURES —

QUALITY CONTROL: "Quality Control and Standardization" by John J. Riordan, Department of Defense 6
Standardization of Quality Control objectives will be a decided benefit to consumers and vendors by jointly delineating what constitutes acceptable quality.

QUALITY CONTROL: "Do You Have a Unified Q-C Program?" by Fay Carlson, Warner Electric Brake & Clutch Co. 74
Mr. Carlson presents in detail the necessary obligations and cooperation required from management and plant personnel to make a Quality Control program a success.

STATISTICAL TECHNIQUES: "Statistical Methods for Solving Top Management Problems" by Edward C. Varnum, Barber-Colman Company 79
Because control charts and acceptance sampling tables are applicable to top management decision problems, the author gives case histories to demonstrate the solutions found to the problems under consideration.

QUALITY CONTROL: "ASQC's 10 Years—Quality Control Their Specialty" 82
An historical outline of the founding, objectives, and growth of the American Society for Quality Control is presented.

ACCEPTANCE SAMPLING: "Plant Application of Acceptance Sampling by Attributes" by S. E. Peters, The Dumore Company 83
Determination of the most effective plan of sampling as practiced at Dumore is presented by Mr. Peters.

QUALITY CONTROL: "Which Standard Deviation?" by Wendell H. Abbott, General Electric Company 86
By example and demonstration Mr. Abbott illustrates the process of determining the standard deviation of a workpiece.

GAGES: "Larger Diameters — Closer Tolerances" by Loyd C. Bigelow, Boice Gages, Inc. 89
A gage manufacturer sets forth some of the conditions that have to be met when using indicator gages for close tolerance gaging of large diameter workpieces.

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QUALITY CONTROL: "Quality Control of Cemented Carbides" by W. C. Seitz and J. H. Powers, Firth-Loach Metals, Inc. 93
To insure production of high quality cemented carbides at Firth-Loach, extreme care is exercised in specifying, testing, and accepting raw materials.

QUALITY CONTROL: "Selling Management a Quality Control Program", Part II, by Ray F. Engelgau, Mueller Brass Co., and Harmon S. Bayer, Quality Control Consultant 95
The authors outline an organized program to follow in establishing a system of Quality Control in the plant after management has given the go-ahead.

MACHINE CAPABILITY: "How Do We Measure Machine Capability?" by R. B. Nottingham, Brush Electronics Company 105
Many of the frustrations which manufacturing personnel experience have their origin in a machine capability problem. Mr. Nottingham gives the procedure to follow in solving the problem.

QUALITY CONTROL: "Quality Control of Job-Lot Production" by Joseph Kalmanek, Scully-Jones and Company 118
Originally it was thought that a Quality Control program could not be successful in a plant where over 50% of the annual production was short-run jobs of about 75 items per order. However, the program as developed is a success.

IN-PLANT S.Q.C. TRAINING: "A Story of In-Plant Training in S.Q.C." by Robert M. Laforge, University of Tennessee 160
The advantages of in-plant statistical Quality Control training as against "short course" training are presented by the author.

PLANT HOUSEKEEPING: "A Plan for Good Plant Housekeeping" by C. P. Hawkins, The Trundle Engineering Company 162
Good housekeeping practices affect practically every variable element of cost of any producing company.

LAMINATE TESTS: "Current Report on Non-Destructive Tests of Laminates" by A. J. Schwarber, Jr., Battelle Memorial Institute and W. R. Graner, Bureau of Ships 174
A report on non-destructive tests performed on glass-reinforced laminates is given.

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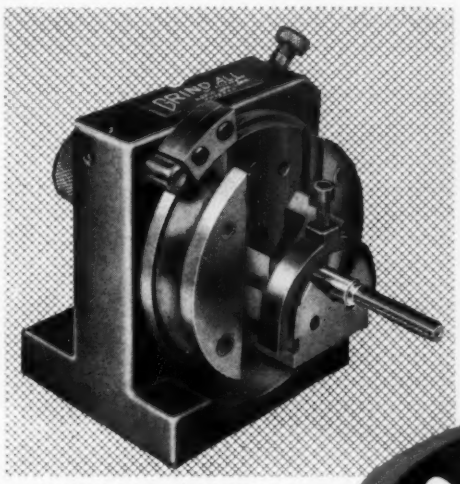

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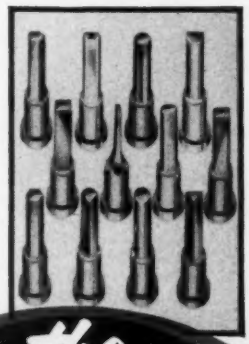

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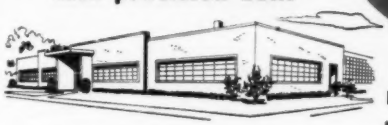

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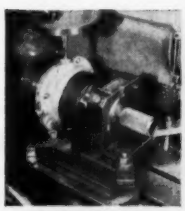

BORING FIXTURE

INSPECTION TOOL

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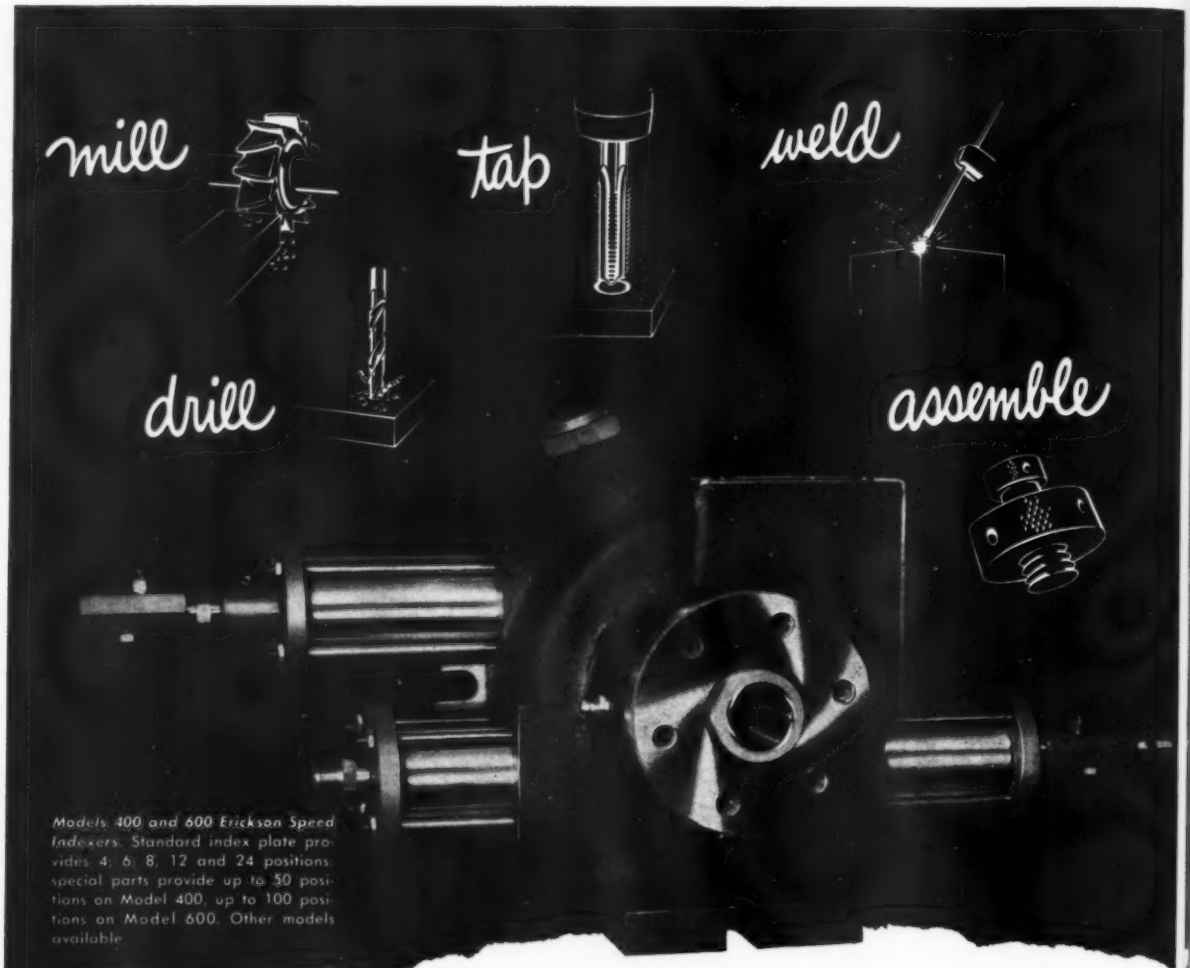

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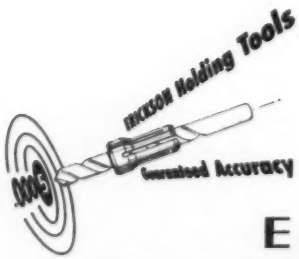

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CIRCLE INFORM-A-GRAM KEY NO. 72

editorial:

Quality Control in kit form

THE ELECTRONIC COMPUTER is coming into widespread use in industry and educational institutions as a highly advanced slide rule and design tool. For the engineer it is a terrific timesaver. Using it as a simulator, he can set up his propositions, depict his theories, or play his hunches, and observe the answers and/or predictions in such a short period of time as would have been impossible a few years ago.

What mitigates against a faster growing use of computers by small research groups and limited budget engineering departments and institutions is the cost of these versatile but intricate tools. Consequently, it is too often only the large organization that can provide its research workers and scientists with a computer compatible with the work to be done.

The fact that now an electronic analog computer of very moderate cost has become available to those with modest budgets who have found commercial computer prices an insurmountable hurdle can, in itself, advance the utilization of computers at a greatly accelerated rate.

Foremost to us, however, is the fact that the computer is offered in kit form for the do-it-yourself builder. Truly, this is a tremendously significant commentary on the attainments of quality control in the electronics industry.

The computer is assembled from literally hundreds of individual parts — vacuum tubes, fixed resistors, transformers, capacitors, jacks, relays and inductors. Although, like any intricate electronics device, the circuitry of the computer can be sub-divided and assembled in relatively simple basic combinations, its over-all performance is a function of the quality standard of each and every part going into its make-up. These must not only be dependable as to conformance to initial engineering specification, but in the case of failure of any one element — tube, resistor or capacitor — an equivalent and dependable replacement must be available from a supplier's shelf.

To us, the concept of an electronic device, be it analog computer, "hi-fi" amplifier, oscilloscope, or "ham" radio communications equipment, in kit form represents the ultimate in dependence upon the quality control of the individual components.

Admittedly, the equipment must be expertly engineered and designed, and the manufacturer must build and prove his pilot models. Henceforth, what he furnishes the user is the assortment of parts necessary to build the end product. His reputation and the successful performance of the final assembly depend upon the quality and uniformity of the individual "bits and pieces" which make up the whole.

The electronics industry turns out millions upon millions of bits and pieces — tiny resistors, capacitors, vacuum tubes, etc., annually. In such quantities, 100% inspection would be economically prohibitive. Accordingly, statistical quality control techniques are used. These, in turn, have forced the development of manufacturing processes and machines capable of producing individual components which are much, much more alike, electrically and mechanically, than the proverbial "two peas in a pod."

Thus, the components represent a high quality acceptance level, and waste and rejects are kept at the irreducible minimum. This is all the more remarkable in an industry which has undergone the fabulous growth which the electronics industry has experienced postwar.

The success of a "kit of electronics" depends not so much on previously developed skills of the do-it-yourself builder, as upon his ability to follow the painstakingly prepared step-by-step text and pictorial instructions of the manufacturer. Again, an example of quality, quality of instructional matter.

In the instance of the electronic analog computer kit, the initiated can gain an idea of its accuracy and versatility by a few of its specifications which call for 30 coefficient potentiometers, each of which is capable of being set to an accuracy of 0.1%; a standard reference supply for all DC voltages; a nulling meter for accurate setting of computer voltages; and a unique patch board layout which enables the operator to "see" his computer block layout.

All this, plus an estimated (and fascinating) 200 man-hours to complete the project, tempts us to get out the old soldering iron.

E. Willard Pennington

MAY, 1956 editor

9th ANNUAL QUALITY CONTROL FEATURE ISSUE

Formal training in sampling procedures, control chart methods, gages and inspection practice, product design and function are a bi-monthly affair for Warner Electric Brake & Clutch Company inspection personnel. Here a member of the Quality Control staff is discussing the principle of an operating characteristic curve typical of one of the sampling methods used at Warner.

DO YOU HAVE A UNIFIED Q-C PROGRAM?

by Fay Carlson
Manager of Quality Control
WARNER ELECTRIC BRAKE & CLUTCH CO.
Beloit, Wisconsin

QUALITY CONTROL is the catch phrase in Industry these days. Since World War II, more and more has been heard of this new industrial technique. Its connotations have made it great ad man's copy, and through television, radio and magazines, from automobiles to beer, the American public has come to know of its existence. With all this publicity, management inevitably asks: What is Quality Control; do we have it; if not, can we get it — or better, can we afford it; and, if we establish such a program, what reasonable returns can we expect?

Many philosophical definitions of Quality Control have, of course, been made through the years, perhaps all describing essentially the same goals. In that respect the following statement will serve as well as any. "Quality Control" is the development and execution of a policy that will insure consistent attainment of the specifications necessary to produce the degree of life, efficiency and interchangeability upon which competitive sale of the product is based . . . and that this be done in such a way as to both insulate the consumer from defective material and still be sufficiently economical as to guarantee the company reasonable hope of profit.

With this definition as a starting point, were we to address these questions in open forum, the result would be a bewildering variation of answers. It would be apparent from the first that many companies making claim to a quality control program have merely hung a new name on an old work horse — in the spirit of the time, shall we say. The chief inspector has put on a quality control hat, but life goes on as usual. At the other extreme stand the adherents of statistical methods. In their philosophy nothing may be dignified by the name "Quality Control" unless it is dressed in a cloak of statistics.

Between these two extremes there are many blends. Neither of these extremes nor most of the blends qualify as a **unified** quality control program. Due to the difference in company product and company organization to company in quality control practice, as in all

other things. Still, certain conditions must be satisfied whether clothespins or aircraft engines are being made. What then are the qualifications?

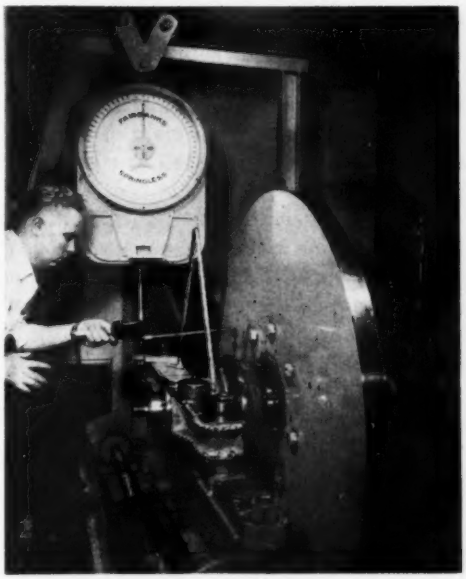
I believe that the following eight conditions for quality are common to the great majority of industrial enterprises. Any workable program that provides adequately for all of them constitutes a **unified** quality control program.

1. A stated and written quality policy.
2. Objective test and development of the product before specifications are fixed and before production is initiated.
3. Realistic and enforceable specifications.
4. Adequate means of measurement.
5. Facilities and program for training personnel.
6. Production participation in quality responsibility.
7. Inspection administration and evaluation by statistical methods.
8. Utilization of quality indexes in product improvement and company planning.

Failure to produce consistent results in meeting product specifications is usually blamed on the shop, but all too often it is found that these failures exist because top management has no well-defined policy with regard to quality. For lack of a policy the shop is forced to assume the function of making decisions that are properly management decisions regarding nonconforming product. These decisions are inevitably motivated more by the expediency of the moment rather than any rational plan.

A plan for quality must begin with management and management must make its policy known in a form that may serve as a constant reference and guide for day-to-day decisions.

Well organized specification files and crib facilities for gages are a "must" if busy inspectors and operators are to get the tools of measurement without delay. Cylindrical plug gages are carefully preserved in plastic from damage.



Planning for quality begins early in the game with testing experimental models with known tolerance variations for significantly better performance. Qualified laboratory technicians follow a prepared testing format to obtain results that can be readily interpreted and represented on production drawings.

A practical means of doing this is to vest in one person or group the responsibility of developing standard operating procedures, which describe both the intent and mechanics of activities relative to quality assurance. With the endorsement of management, such procedures become the stated policy of management.

Another area unusually ripe for both product improvement and reduction of manufacturing costs is found in design engineering. Yet this area is rarely exploited effectively. In some instances the new product is put in production upon the flimsiest pretense of test data. When this occurs, specifications are obviously arbitrary and dimensions are identified to the real requirements of the product in a purely superficial fashion.

When the true requirements are unknown, the tendency is to impose close tolerances as a safety factor. The shop is therefore handicapped from the outset, and unbeknownst to him, the customer carries out the test program that ultimately establishes the final design of the product. Considering the expense and ill will for all concerned, there must be an easier way.

The logical recourse is to accept the responsibility and cost of an objective test program. A sincere effort in this direction is carried out by most companies. The regrettable aspect of

all this effort is the fact that the experimental tests, all too frequently, are poorly designed or the data obtained is improperly evaluated because it is subjected to a purely empirical analysis. The company therefore not only fails to realize the full potential yield of a test program but, indeed, may be led to costly incorrect assumptions.

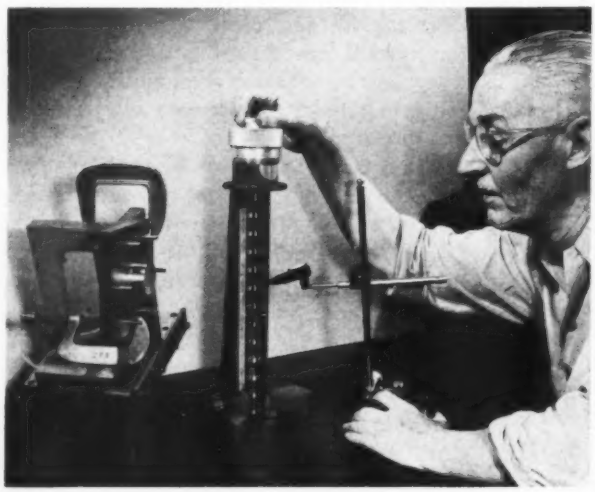
With only a descriptive introduction to statistical methods, one learns the naivete of accepting apparent results of a small sample as a true criterion of expected results for the product in general. The statistical method is the missing ingredient that provides the opportunity for more effective planning and analysis of experimental tests. Primarily it makes possible the conduct of a test in such a way that a combination of critical variables, which is significantly better than other combinations, can be picked out from results that are merely a reflection of random variation. This done, statistics may be used further to predict the ultimate extremes of various functional characteristics of the product when manufactured to given specifications.

A test program of this nature obviously opens the road to specifications and tolerances where many economies can be immediately realized. Such being the case, it hardly seems necessary to state item three as a separate point in the foregoing but for one unfortunate practice: that of establishing tolerances closer than the known requirements on the assumption that the shop will exceed the tolerance anyway. This is immature thinking of the worst kind and only serves to aggravate the condition for which it is meant to compensate. Tolerances should be as liberal as the requirements for the product will permit; anything less is cost to the company for needless precision. These tolerances must then be enforced by shop supervision as their prime responsibility.

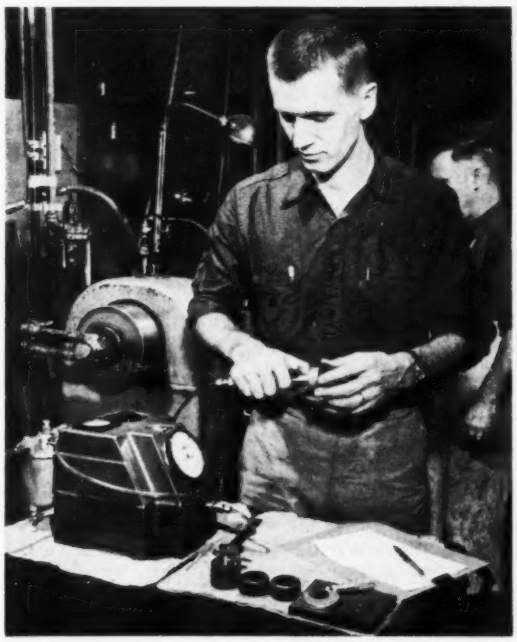
When a product has been realistically spelled out in terms of specification, dimensions and tolerances, it is ready for tooling, manufacturing, and subsequently, evaluation by inspection. Efficient evaluation, anticipation, and prevention of defective product all hinge upon effective means of measurement. Means of measurement and method of measurement should be determined by analysis of each component part and assembly.

The necessary gages and any special qualification as to use must be set down in some readily referenced form, providing for every dimension and characteristic. As an inspection procedure card, or in some other form, this information must be available to shop personnel. The inherent economy of this practice is certainly obvious. A detailed analysis, by a person well grounded in the science of measurement, will automatically spell out the quickest and most accurate methods obviating the necessity of such an analysis being made by shop personnel each time the part is run, with perhaps less effective results.

Extensive economies can also be realized in the design of special purpose gages. This becomes practical if volume of production is even moderately high, for by such means inspection time can be greatly reduced and inspection accuracy greatly increased. Implication alone tells us that, once the tools of measurement



Gage inspection and gage control insure accurate measurement with the assurance that the gage meets gage tolerance and does not introduce an error in checking the production part. All of the gages and instruments display the characteristic "GA number" by which they are identified to the proper gage inspection record card.



First piece inspection, with all the gages called for by the job, is made by the patrol inspector. Here we see that the bore diameter is on the split limit and all other dimensions are in tolerance. The operator is given the "go ahead" and the patrol inspector enters the result of his initial inspection on his Quality Control chart. His hourly sampling inspection of the operation will follow, using a statistical sampling procedure to guide his volume of inspection and his decisions.

have been provided, a stringent gage control and inspection must be maintained.

Point five, adequate means of training personnel, is another item that is so commonly recognized as necessary that it hardly seems needful of mention. At the shop level a man is selected for a job on the basis of his experience and his ability to learn. Further training is usually carried out informally. In practice this works out reasonably well and may cover the individual requirement. Formal training, on the other hand, has its major merit in providing a medium by which the general understanding of the group can be upgraded and policy concerning specific situations standardized.

Such a program becomes especially worthwhile if the function of the group is first broken down into primary areas of information and vocational guidance tests are given to evaluate the general level of understanding and aptitude of the group in these areas. Communication of ideas and instructions, from the planning level down to the shop level where these procedures are carried out, is greatly implemented through a long range training program, and in this way a well planned training program plays an important role in a successful quality control plan.

Where an extensive inspection and quality control program has been launched, one common pitfall must be avoided, i.e., the tendency of production personnel to shift the responsibility for quality to the inspection group. In every industrial enterprise the first instrument of quality is the machine operator. His foremost responsibility is to guarantee conformance to specification. This precept must be reiterated time and time again for it forms the cornerstone of any quality control program. Production participation in quality responsibility must therefore be well defined in the stated policy of the company and enforced throughout its operation.

Inspection as a separate and distinct group exists chiefly for three purposes:

a. evaluation of incoming product as a safeguard against accepting defective parts;

b. evaluation of outgoing product as a means of insuring the customer against defective assemblies; and

c. evaluation of product in process as an auxiliary force to operator inspection in anticipating and preventing defective product from being made.

To these ends, partial examination or sampling inspection of lots is the usual practice. Due to the complementary aspect of mating parts, a small percentage of defectiveness is unlikely to affect assembly or performance. The probability of interference or too much clearance, where an out-of-tolerance condition exists, can be readily calculated by using formulas drawn from statistics relative to overlapping distribution. If this is true, we are in a position to accept some defective product and

when using sampling inspection it is inevitable that we will do so. Something in excess of 100% inspection would be required to guarantee 100% conforming parts since 100% inspection is itself less than 100% effective due to the element of fatigue and distraction.

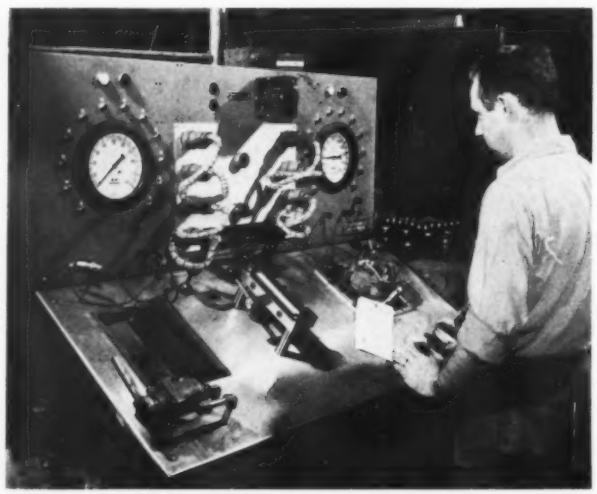
Our problem, therefore, is one of establishing a sampling method which will give us good discrimination against lots of such a degree of defectiveness that interchangeability and efficiency of the assembled product will be compromised. The statistical methods that have become popular under the heading of Statistical Quality Control serve this need admirably. With statistics as an administrative basis for inspection effort, inspection becomes a science of calculated risk and is no longer entirely at the mercy of chance. However, if product quality is not good enough to pass sampling inspection, 100% inspection will result regardless of the statistical method used.

Inspection and quality control have a valuable by-product in that they provide the data for quality analysis. This important work, summarized as a quality index, must be done if the trends of improvement or deterioration are to be seen, and the specifics drawn out for consideration and action. A quality index may, of course, be developed in many ways and its computation greatly facilitated by the use of forms that can be mechanically sorted; however, as it is developed, it must be a dynamic instrument of product improvement and not merely a static report.

Through the use of such an index, the items that constitute chronic failure can be readily differentiated from those that are merely incidental failures. A trouble-shooting group or a product improvement committee can operate very effectively armed with detailed information of this nature. Without knowing accurately the cost, frequency, or proportional amount of failure they are handicapped, to say the least. As an aid to top management, quality performance, as reflected in a quality index, should be considered in company planning concerning new products, new machine tools, and in cost estimating.

It is apparent from what has been said that quality is not the responsibility or the success of a single group. All groups involved in the design and manufacture of a product share quality responsibility. By these lights, success or failure in the matter of quality reflects their total composite effort. The foregoing outline is an attempt to highlight the individual facets of this over all effort. In practice these requirements may be fulfilled quite elaborately or with complete informality. What degree of formality and specialization is most appropriate for a company is largely a matter of product, growth, and customer acceptance. As the size of the company increases and the product becomes more complex and diversified, specialized services become more mandatory. Judgment on the part of management must prevail in this matter as in all others.

Be that as it may, quality is not the result of happy chance. Product integrity and reputation comes only from intelligent planning and efficient execution of a **unified** quality control program. To disregard the basic conditions for quality, or the sharp tool statistics offer for their accomplishment, can only result in loss to the company in these competitive times. ΩΩ



Electrical characteristics are critical and here we see an inspector operating a test stand where the relationship of pressure to resistance is checked and adjusted on a Warner Hydraulic Controller. All such characteristics are given 100% inspection in final inspection, and the units are identified by the inspector's stamp.

STATISTICAL METHODS FOR SOLVING TOP MANAGEMENT PROBLEMS

by Edward C. Varnum
Head, Operations Research
BARBER-COLMAN COMPANY
Rockford, Illinois

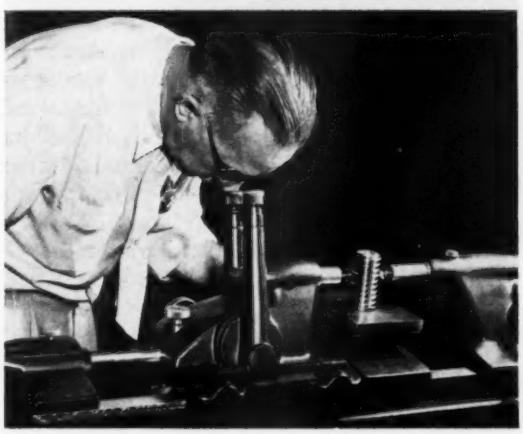
THE GROWTH of the use of statistical techniques in industry reflected by a rapidly increasing membership in the American Society for Quality Control during the past decade, has been followed by the wider application of statistical and mathematical methods to all operations of the plant. Probability concepts basic to Shewhart control charts and acceptance sampling tables are applicable to top management decision problems, equipment efficiency predictions, sales potential determinations, replacement analysis assumptions and design tolerance calculations. Case histories relating to these diverse applications at Barber-Colman Company are discussed below.

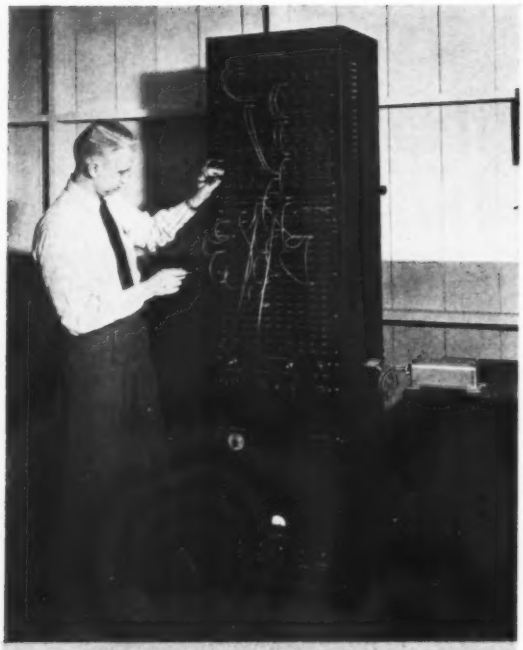
In contrast to the liberality of detail found in early quality control case histories, reports of recent developments are often presented in heavy paraphrase, such as the following generalization of a specific problem recently solved for our top management: There are five teams with 15 players on each team. We know the highest and lowest score that any player can obtain in a given "game". We also know the average score for each team, and want to know whether these five averages are significantly different; i.e., is the variability of the averages more than could be possibly expected?

To obtain a sufficiently accurate answer for practical purposes, it was assumed that the central limit theorem[1] would assure a Gaussian, or normal, distribution of the averages and that the six-sigma range of individual scores is the difference between the known high and low bounds. With these assumptions, statistical relationships were used to answer the question of between-team variability. Although the assumptions were crude and the arithmetic simple, the results were useful in pointing out one or two "teams" in several "games" to which administrative attention was given.

The diversity at Barber-Colman Company lies not only in its products but also in its activities, which include research and development in addition to the customary design, production, inspection and sales operations. In a development problem, we wanted to know how efficient a certain type of machine would be, subject only to the faults inherent in the ma-

Over-pin measurements of worms to accurate limits involve precision checking equipment along with exact mathematical formulas developed by Barber-Colman engineers.





Barber-Colman's R. W. Hanna making a computer setup. The analog computer solves mathematical analysis problems encountered in performance predictions for the aircraft control assembly (right) that is plugged into the computer.

terial processed by the machine. From statistical data on this material, we carried through a Monte Carlo solution. Briefly, the Monte Carlo method consists of making a mathematical game of chance having outcomes numerically similar to the various possible happenings in the problem itself. The game of chance is then played a sufficiently large number of times and a statistical analysis of the game's results provides a solution to the problem.

In our development problem, for example, the final result was simply the total number of unit-outages divided by the total possible number of unit-times. Although in our immediate solution to the problem we used a small table of random numbers and a desk calculator, the problem was later set up on an electronic analog computer using a radioactive source for generating random numbers.[2] The numerical results of the analog computer calculations were in statistical agreement with our earlier crude results and our development manager's decision would have been the same.

In addition to the administrative and development problems described above, statistical methods have been applied to our sales activities, as illustrated by a sales office potential study made for the sales manager of one of our divisions.[3] The first part of the study applied correlation techniques to various sets of data in order to select a proper set to be used as **potential** figures. With this set of data plotted horizontally and the actual dollar volume plotted vertically, the resulting set of points corresponding to sales offices were fitted by a straight line using the theory of least squares. This line of best fit is used as a boundary for classifying sales offices into two groups of relative performance compared to their potential.

In all three of the case histories mentioned, the end result of the statistical manipulations was a managerial decision. In the past few years a great body of statistical literature has been devoted to **decision theory.**[4] The doctors of philosophy who publish these theories are not managers themselves, nor, in general, even report to any industrial manager and thus the actual applications lag behind the theories. Furthermore, the exact details of successful industrial applications of the newer advanced theories are generally withheld, or at least heavily paraphrased. Nevertheless, the gradual dissemination of new statistical theories in textbooks, industrial seminars, technical journals and trade literature is leading to the use of linear programming, game theory, Monte Carlo methods, queuing theory, symbolic logic and the theory of extreme values, along with the more classic methods of analysis of variance, significance tests and Shewhart control charts.

The top management problem described in our second paragraph is an example of a simple **significance test** in which we determine whether observed differences are significant or just due to chance. Such tests are also used by our aircraft controls design department to evaluate characteristics of contemplated components. The t-test for the difference of two means[5] has been used to find how well these components can "zero in", the F-test[6] told whether the desired component variability can be held, and the Chi-square test[7] has decided whether experimental results fit expected results sufficiently well.

For several years Barber-Colman Company has been active in a trade federation, Machinery and Allied Products Institute, which has developed a widely accepted equipment replacement policy.[8] Prior to the making of the fundamental assumptions, a statistical study of the operating characteristics of many types of machinery was made by MAPI.[9] In instituting the MAPI program in our own plant, we made extensive statistical studies of equipment records, with especial reference to service life and salvage value. From time to time, additional surveys are made, the most recent

being a study by an Illinois Institute of Technology graduate student at the National Center for Dynamic Equipment Policy, relating our equipment acquisition policies to national trends.[10] Such continuing studies serve to keep our equipment replacement analysts aware of our position within the industry. In addition to these statistical studies, our Company has worked closely with MAPI in the mathematical development of the theory.[11]

Before discussing our use of statistical methods in the inspection operation itself, another non-inspection application will be described. Practical applications [12] of the statistical properties of two overlapping distributions[13] have been made in the setting of design tolerances. Theoretical considerations show, for example, that from two normal distributions having a common standard deviation of 10 units and a difference of 30 units between their means, pairs of randomly selected values will exhibit interference only 17 times out of a thousand. This says that for equally wide spreads if the high limit of one tolerance is the split limit of the other, then in 983 pairs out of 1000 selected at random the larger number of the pair will come from the distribution with the larger mean.

We have purposely left the use of statistical methods in inspection until the last in order to emphasize the incorrectness of the widespread impression that statistics is used only by inspectors and that "quality control" is the final word in industry's use of statistical and mathematical techniques. In some instances, quality control departments have led the way in the use of statistical methods in plants whose engineers now use log normal distributions in life test analysis[14] or whose sales analysts use two-sigma limits with cumulative averages.[15]

Precision grinding operations insure narrow Shewhart control chart limits on Hendey lathe beds.

An optical comparator is used for precision measurement of forms on machine tool parts and on small tools produced at Barber-Colman.

In our plant, our quality control personnel under the direction of Joseph D. Viden use modified Shewhart control charts and acceptance sampling forms based on Mil. Std.-105A. Mr. Viden's contributions include a symbolic designation of the signs "plus", "triangle" and "square" to indicate "critical", "major" and "minor" characteristics with AQL's of 0, 1.5 and 4.0, respectively, along with the design of appropriate forms. Standard multiple, sequential, and continuous sampling plans are modified for our own use. Basic ideas and procedures recommended by resident Air Force inspection personnel are extended for use on non-governmental products. ΩΩ

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ASQC's 10 Years . . .

Quality Control Their Specialty

TWO HEADS ARE USUALLY BETTER than one, and in engineering circles especially, the organization and dissemination of thoughts on a nationwide scale reap more bountiful rewards. Such was the thinking of some of the country's top Quality Control specialists when they formed the American Society for Quality Control 10 years ago.

As Quality Control has gained in importance during the past 10 years, the ASQC has grown from 275 founding members to almost 9,000. The Society hopes to cap its tenth anniversary celebration this year with the addition of member number 10,000.

The ASQC was officially launched in February 1946, at a meeting at the Edison Electric Institute in New York. Groundwork for an organized Quality Control organization had been laid some six years before, though, when Dr. Walter Shewhart, called the father of Q-C, suggested at a joint meeting of the American Statistical Association and the Institute of Mathematical Statistics that initiative be taken in calling together an interested group in the Pittsburgh area.

The Society of Industrial Quality Statisticians grew out of that suggestion in 1941. In 1943 it was more formally organized as the Pittsburgh Chapter of the Institute of Mathematical Statistics, but it did not thrive.

World War II, with its mechanized warfare, says Martin A. Brumbaugh, ASQC historian, produced a situation which mandated the spread of Quality Control techniques. Both the number of trained inspectors and the methods of inspection, at the beginning, were inadequate. First step toward a solution to this problem was taken in 1941, when George D. Edwards of Bell Telephone Laboratories was requested by the Ordnance Department to make a thorough study of Ordnance procedures.

One outcome of the resulting program was the development of a series of "Army Ordnance Inspection Tables." Another, a series of short educational courses throughout the country for training officers and government engineers in the general principles of acceptance Q-C and in the specific application and use of the Inspection Tables.

A final result was the organization of Q-C and inspection training courses for military suppliers. These were set up by the War Production Board and the Office of Production Research and Development, under the management of Dr. Holbrook Working. All but one of the 13 local societies out of which the ASQC was formed, notes Brumbaugh, were an outgrowth of the 8-day courses on Q-C which Dr. Working directed.

By 1943 there were numerous local Q-C organizations, and leaders in the field began thinking and talking in terms of a national society. Dr. Working and Dr. E. G. Olds, also associated with the WPB-OPRD program, presented the case for organizing nationally to the Applied Mathematical Statistics Committee of the National Research Council. Dr. Shewhart headed a sub-committee of this group, which investigated the idea and reported favorably at an organizational meeting in October 1945.

The following February, George D. Edwards, Director of Quality Assurance at Bell Telephone Laboratories, took over as first ASQC president. Andrew I. Peterson, Manager of Q-C at R.C.A.'s Victor Division, was elected vice president; Ralph E. Wareham, Manager of the New Products Division of National Photocolor Company, secretary; and Alfred L. Davis of the Rochester Institute of Technology, treasurer.

Throughout the years, the ASQC has taken on and completed numerous noteworthy projects. The Society's technical activities are now grouped into divisions (Automotive, Aircraft, etc.) according to the major interests, because of its size. ASQC annually rewards outstanding men in the field; holds conferences, clinics, and conventions; and has maintained publication of its own magazine, "Industrial Quality Control," which was started in 1944 as publication of the Buffalo Q-C Engineers.

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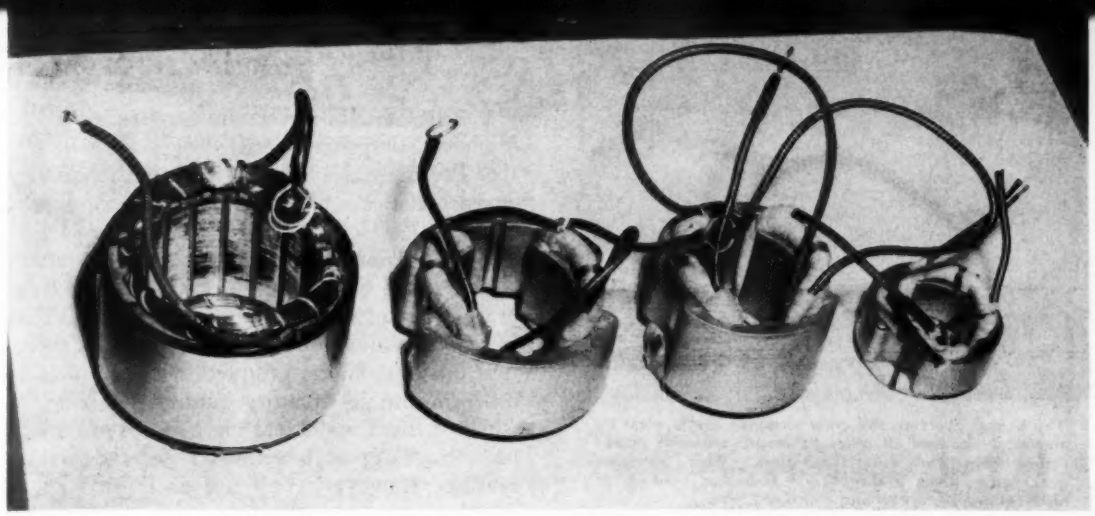


Originally subjected to 200% inspection (100% by the assemblers and 100% by "receiving inspection") these Dumore electric motor field assemblies are processed by the sampling plan referred to in the text.

Plant Application of Acceptance Sampling by Attributes

by S. E. Peters
Chief Inspector
THE DUMORE COMPANY
Racine, Wisconsin

THE DUMORE COMPANY of Racine, Wisconsin, manufactures universal electric motors and portable motor-driven electric tools and appliances. We are, therefore, classified in the metalworking industry; and, our ratio of inspection and quality control to direct labor is 1/20. Inspection and Quality Control is under the chief inspector, and includes tool inspection and the specification and control of gages.

Product quality is the result of many things, all interdependent. These can be divided into two general categories:

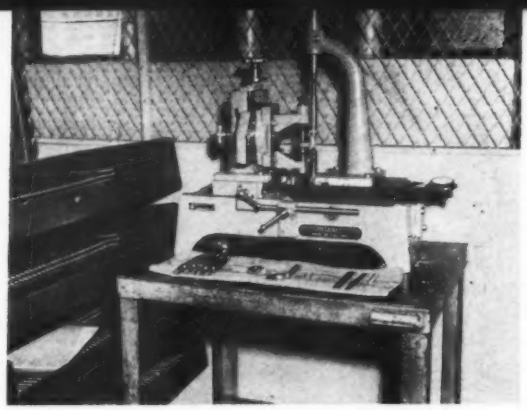
1. Quality Control by inspection and statistical methods, and
2. Other things.

Let us approach Quality Control by way of the "other things" first.

Let us begin with Harrington Emerson's "Twelve Principles of Efficiency" which he used as a check list to measure the success of any venture, and which apply to Quality Control equally as well. They are:

1. Clearly defined ideals. (Formulated purpose and methods.)
2. Competent counsel. (If you don't know, ask someone who does know.)
3. Common sense. (Uncommon good sense. Use good judgment — don't guess.)
4. Discipline. (Especially self-discipline.)
5. The fair deal. (The Golden Rule, meaning good personnel relations.)
6. Reliable, immediate, and adequate records. (Of especial significance in Quality Control and statistical methods.)
7. Dispatching.
8. Scheduling. (Dispatching and scheduling constitute production control.)
9. Standard conditions.
10. Standard practice.
11. Written standard practice instructions.
12. Efficiency reward. (Give credit where credit is due.)

A **high quality product** is a combination of **men and materials,** furnished with **proper facilities,** motivated by **proper ideals,** seasoned with **proper standards,** and maintained by **proper controls.**



The helical gears on the ends of motor shafts must be accurately hobbed in order to insure efficient power transmission and quiet operation. This precision gear tester gives a direct dial indicator reading of pitch circle diameter and concentricity.

The proper facilities consist of good tools; a clean and orderly work place; good lighting; good conveniences; etc.

The ideals consist of a cultivated state of mind — quality mindedness and pride of workmanship.

The proper standards consist of standard conditions; standard practice; and written standard practice instructions.

The proper controls consist of proper management, together with reliable, immediate, and adequate records.

The objective of the Quality Control department is "To facilitate the economical production of products of uniform and satisfactory quality."

This is accomplished in two ways:

1. By traditional inspection, i.e., by measuring, testing, accepting, and rejecting, and,

2. By statistical methods, i.e., by the gathering, arranging, analyzing, and disseminating of inspection, and quality data.

Quality Control, as thus outlined, is about ninety percent engineering and inspection, and about ten percent statistical methods. However, quality control without the statistical methods is only about fifty percent efficient. (Any chief inspector who does not become familiar with, and who does not apply statistical methods, is on the road to oblivion.)

Traditional inspection, which maintains quality by screening out the defectives, is uneconomical due to the fact that it has very little ability to improve quality or to increase production efficiency; whereas, the statistical methods do have that ability. The statistical methods :

1. Predict and prevent scrap and rework.

2. Reveal when corrective action should be taken.

3. Prevent wasted time and energy in trying to correct trouble that does not exist. (Trouble that may be normal variation.)

4. Ascertain the economical amount of inspection required.

5. Provide data for establishing rational tolerances and specifications.

6. Provide data for evaluating the quality characteristics of men, materials, and machines.

7. Will improve quality through less scrap and rework; will increase production and operator earnings; and will decrease costs. (That is the objective previously stated: "To facilitate the economical production of products of uniform and satisfactory quality.")

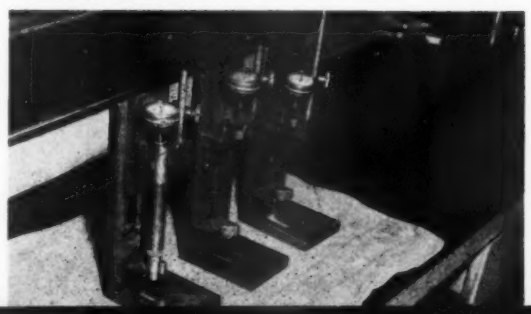
All of these statistical methods have a highbrow ancestry of advanced logic and mathematics. However, their use does not require the services of a mathematician or a statistician and more than the services of a machine design engineer are required to operate a machine tool or a typewriter. Simple arithmetic, the addition of, and a familiarity with, a few new words in our vocabulary, plus a little practice and experience will do the trick. As Shewhart so aptly said: "Industry does not require statisticians so much as it requires engineers trained in statistical methods."

Where do we apply these methods? This is determined by our inspection reports. We apply them to those processes and products having excessive scrap and rework; we apply them in inspection to reduce screening and 100% inspection; and we use them to control and hold the advantages gained. We investigate the possibility of using a sample plan in place of 100% inspection, for example:

The assembler of a subassembly—a field for a universal motor—spends the last hour of each day 100% inspecting his day's production. The motor fields are then traveled to Receiving Inspection for another 100% inspection before they are delivered to the stock room. This was traditional, and thought to be very necessary. This inspection is for attributes — grounds, shorts, opens, etc.

A summary of past records revealed that the scrap and rework on this subassembly, for all causes, including final assembly and final test in the motor, was less than 2%. It was also found more economical to remove and replace five defective fields in motors than it was to

These special, universal checking fixtures, with built-in dial indicators, plus a master setting gage, control all length elements.



100% inspect 100 fields. Obviously, we were using 200% inspection and wasting time and energy in looking for trouble that did not exist.

This prompted a consideration of a sampling plan to be used at Receiving Inspection, and the elimination of inspection by the assemblers. We had a copy of the Bell System Technical Journal containing the Dodge-Romig tables, and we had a copy of a quality control training manual used in a short course by the University of California which gave a comparison of several sampling plans including Dodge-Romig. The comparison consisted of four plans.

Plan No. 1.

The constant percentage plan — the 10% plan. In this plan 10% of every lot is inspected, and if there are no defects in the sample, the entire lot is accepted. If there is one (or more) defective, the lot is inspected 100%.

In this plan the samples from small lots are not large enough for adequate judgment of the

A dial center gage is used to test trueness of shaft end centers. This check insures economical plunge grinding, with subsequent uniformity of finished pieces.

lot, while samples from large lots are greater than necessary for adequate judgment of the lot.

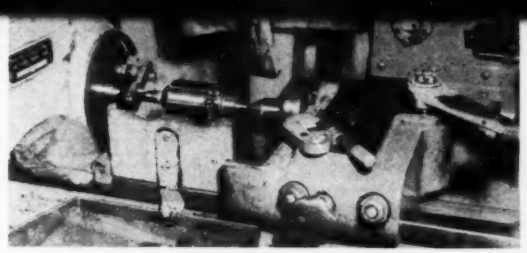
Plan No. 2.

The constant number plus constant percentage plan. In this plan the sample consists of a number plus a constant percentage of the remainder. If there is one (or more) defect in the sample, the lot is inspected 100% the same as Plan No. 1.

This plan is an improvement over Plan No. 1 inasmuch as the constant number can be made large enough for adequate judgment of small lots, but for very large lots, the sample again, as in Plan No. 1, becomes larger than necessary for adequate judgment of the lot.

Plan No. 3.

The constant number plan. In this plan one defect in the sample is also cause for 100% inspection of the lot. This plan is superior to both Plans No. 1 and No. 2 inasmuch as the sample for small lots can be adequate for judgment of the lot, and still not be excessive for large lots.



Indicating micrometers and master setting discs enable the grinder operators to maintain accurate and uniform diameters in armature shaft grinding.

Plan No. 4.

A.O.Q.L. (Average Outgoing Quality Limit) plan — Dodge-Romig single sampling. This plan has a sample size varying with the size of the lot.

This plan is superior to all three of the foregoing plans. The samples are never too large or too small for adequate judgment of the lot, regardless of the size of the lot.

Lot Size (N)	Sample Size (N)	A.O.Q.L.
CONSTANT PERCENTAGE		
10	1	33.1%
100	10	3.31%
1,000	100	.331%
10,000	1,000	.0331%
100,000	10,000	.00331%
CONSTANT NUMBER PLUS % (100 + 5%)		
10	10	.00%
100	100	.00%
1,000	145	.22%
10,000	595	.058%
100,000	5,095	.0068%
CONSTANT NUMBER		
10	10	.00%
100	100	.00%
1,000	300	.086%
10,000	300	.118%
100,000	300	.122%
A. O. Q. L. (.1%)		
10	10	.00%
100	95	.1%
1,000	270	.1%
10,000	355	.1%
100,000	365	.1%

A tabulated comparison of the four plans, with various lot sizes, and with the associated A.O.Q.L. for each case is given in the accompanying tabulation.

We chose the Dodge-Romig plan. This plan is based on a minimum inspection for a given quality assurance at a given risk for any process average percent defective.

For the motor field problem we selected table SA-1.0, single sampling, based on A.O.Q.L. We wanted the 1% A.O.Q.L., and as our lot sizes were seldom less than 200, we were satisfied with the corresponding 5%, or less lot tolerance.

This plan has served us very well — we very seldom need to screen a lot by 100% inspection; our inspection is now 20% in place of the former 200% inspection; scrap and reworks are unchanged; our productivity is increased; and our costs are substantially decreased. We have since revised much of our sampling procedures along those lines. ΩΩ

WHICH STANDARD DEVIATION?

by Wendell H. Abbott
Supervisor, Statistical Section
Lamp Division
GENERAL ELECTRIC COMPANY
Cleveland, Ohio

IT IS DIFFICULT ENOUGH for the average man in the shop to grasp the idea that the variability of a product is measured by a mysterious thing called "standard deviation," which is made more formidable by giving it the Greek moniker "sigma."

To be told that the same product may have several different standard deviations would appear to pile bewilderment on confusion. We cannot, however, close our eyes and hope the horrid fact will disappear, because failure to recognize its existence frequently leads to serious error in the interpretation of sampling data.

For purposes of illustration, we will use the measurements of some imaginary "gimmicks." These gimmicks have a nominal outside diameter of 0.250". They are made from drill rod $\frac{1}{32}$" larger than finished size, cut to $\frac{1}{64}$" oversize on a lathe, and then ground to finished size. Measurements are made on a dial micrometer, from a zero setting at 0.250", to the nearest ten thousandth of an inch.

The measurements in Table 1 were adjusted from the zero setting to actual diameters. Five samples of five gimmicks each were taken on five different days, but on each day the five gimmicks are all from a single set of conditions; i.e., the lot from which the samples were taken was kept as a distinct group throughout the manufacturing process. They are all from the same lot of material, all went through the lathe and grinder, respectively, with a single tool setting on each machine, and all were measured by the same inspector with the same setting of the dial micrometer.

We should, of course, have 15 or 20 such samples to give us a representative cross section of conditions, but these five will serve the purpose of this illustration.

We could easily obtain the standard deviation **within** these samples by dividing the average range by the appropriate d_2 factor, which would give us a reasonably accurate estimate of our process capability. Standard deviation would be .00396 when calculated in this manner. A more precise computation, using the formula

$$\sigma^2 = \frac{1}{n-1}\left(\Sigma x^2 - \frac{(\Sigma x)^2}{n}\right)$$

and taking the root-mean-square of five such calculations would give us a value of 0.003775, which we will use in the subsequent discussion as the standard deviation **within** a single set of conditions.

We have emphasized the designation "within" to indicate that this is the standard deviation applying to the variation of individuals within any single lot made from a single lot of material with single tool settings on each machine, and one time of measurement by a single inspector.

Table 1

Sample No.	1	2	3	4	5
	.2526	.2543	.2437	.2449	.2583
	.2540	.2466	.2419	.2541	.2546
	.2499	.2531	.2433	.2409	.2589
	.2449	.2586	.2429	.2484	.2501
	.2487	.2500	.2407	.2494	.2558
Average	.2500	.2525	.2425	.2475	.2555
Range	.0091	.0120	.0030	.0132	.0088

Grand Average .2496
Average Range .00922

It is a fundamental of the control chart technique that sample averages will vary from the actual average of a large lot in a normal pattern whose standard deviation is the standard deviation of individuals divided by the square root of the sample size.

In our present example, if the process is held to its specified center of 0.250", the standard deviation of our sample averages should be

$$.003775 \div \sqrt{5} = .001688.$$

However, if we calculate the standard deviation **among** these five averages, using the above formula, we find that it is .00496. We may therefore conclude that the actual averages of the five different lots, represented by these samples, were not identical, but varied from lot to lot.

We thus have two independent sources of variation — the variation which is inherent **within** any single set of conditions, and the variation **among** different lots, which is presumably due to different machine adjustments, tool wear, differences between machines, operators, inspectors, etc. Differences between different lots of material frequently cause a considerable variation among product lots, although we have chosen to ignore it in this illustration.

As a result of these two systems of variation — within and among lots — it is obvious that the variation of individuals in the product as a whole will be greater than the variation of individuals in a single lot made under a single set of conditions. The standard deviation of the product as a whole, which we will call the total standard deviation, is not the sum of the standard deviations within and among lots. Instead, we have to use the squares of these values; so total standard deviation is the square root of the sum of the squares of the two component standard deviations.

This is the familiar relationship of the sides of a right triangle, where the square of the hypotenuse equals the sum of the squares of the two sides. Such a triangle, showing our three standard deviations is represented in Figure 1.

It will be noted that the standard deviation among lots, .004262, is somewhat less than the value, .00496, which we computed from the five sample averages. This is because the latter includes not only the variation between the centers of **different** lots, but also the variation of sample averages about the centers of **each** lot. Computations involved in the separation of these two might be confusing to those not familiar with the analysis of variance.

Instead, since the hypotenuse of our triangle represents the total standard deviation of all the individuals in many lots, we can determine its value by computing the standard deviation of the 25 individuals as a single group, using the above formula. This computation gives us a total standard deviation of .005694. We can now subtract the square of standard deviation within lots from the square of total standard deviation to obtain the actual standard deviation among lots, as in Table 2. Decimals are omitted.

Projections of the sides of the triangle to the hypotenuse are in proportion to the squares of the component standard deviations; so we have determined that 44% of the variation of our gimmicks is inherent within any single set of conditions, and 56% is due to variations among different lots.

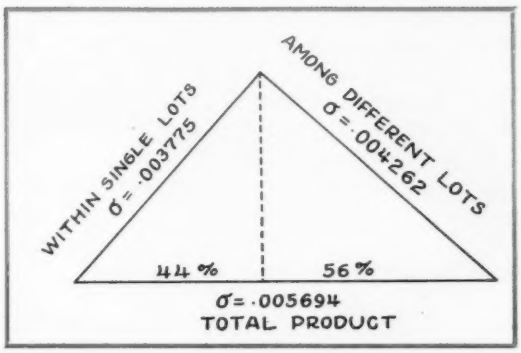


Figure 1

In a process as clearly defined as in our example, it would be a simple matter to devise a statistically designed experiment which would determine, with reasonable accuracy, how much of this 56% may be attributed to variation among lathes, grinders, and measurement.

Table 2

	σ	σ^2	% of Total
Total	5694	32421636	100
Within	3775	14250625	44
Among	4262	18171011	56

We will assume that such experiments have established standard deviation for each step, as shown in Table 3. Decimals are omitted.

We can now represent the variability of our product by the series of triangles shown in Figure 2. The successive projections of the several sides to the hypotenuse of the largest triangle will divide this line in proportions shown in the percentage column of Table 3.

We now have not only the five standard deviations shown in Table 3, but also the standard deviations of several other possible combinations of variables. Using the identifying letters in Table 3, and remembering that (a) is an essential condition in any lot, we could have any of the following combinations:

(a) A single set of conditions

$$\sigma_a = .003775$$

(ab) A single lot but measured at several different times, or by different inspectors

$$\sigma_{ab} = .004183$$

(ac) A single lot but distributed among several lathes or tool settings

$$\sigma_{ac} = .004554$$

(ad) A single lot but distributed among several grinders or tool settings

$$\sigma_{ad} = .004763$$

(abc) Same as (ac) but measured at several different times or by different inspectors

$$\sigma_{abc} = .004898$$

(abd) Same as (ad) but measured at several different times or by different inspectors

$$\sigma_{abd} = .005091$$

(acd) Several different lots but measured at one time

$$\sigma_{acd} = .005393$$

(abcd) Randomization of total product

$$\sigma_{abcd} = .005694$$

Table 3

	σ	σ^2	% of Total
(a) Within Any Lot	3775	14250625	44
(b) Among Measurements	1801	3244840	10
(c) Among Lathes	2548	6489630	20
(d) Among Grinders	2905	8436541	26
TOTAL	5694	32421636	100

Thus we see that eight possible standard deviations could apply to our simple little gimmick, depending upon the degree of randomization exercised in the selection of samples.

The Quality Control engineer will, of course, argue that all of these gimmicks should have been held more closely to the process capability represented by the standard deviation of .003775. This is the essential purpose of the control chart technique.

There are many products, however, where such close control is impracticable, either because the sources of variation have not been isolated, or the requirements of the service do not justify the cost of such precision.

Control charts with modified limits are well adapted to controlling such a product within specified limits, but control limits and specification tolerances should be based on an understanding of the several sources of variation and the proper standard deviation applying to each specific condition.

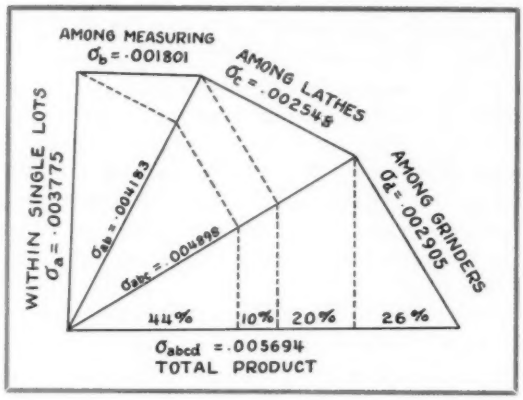


Figure 2

Probably the most frequent error in the use of these standard deviations is in the comparison of samples from a single set of conditions with a well randomized sample. Unless randomization occurs automatically by mixing or blending during the manufacturing process, all the articles from a single package are likely to be from a single set of conditions. To compare such a sample with one randomized to represent a cross section of the whole product is usually meaningless.

Standard deviation derived from any group of sampling data applies only to the conditions which produced those samples. The experienced analyst, who has been confronted with data obtained under every such possible combination of variables, will insist that the exact conditions represented by any group of sampling data be clearly defined. ΩΩ

LIQUID SPRING DELIVERS 8000 LBS. OF SPRING FORCE

A liquid spring of revolutionary design, incorporating a built-in shock absorber, has recently been evolved and is known as the Taylor Liqui Spring-Shok.

This combination spring and shock absorber, developed by the Taylor Devices Inc., North Tonawanda, N. Y., incorporates an integral hydraulic levering principle which permits the development of spring forces as low as 600 lbs with a 2" stroke plus energy absorption as a shock absorber. Wide extremes of spring force are possible with the same components while maintaining sturdy piston members of any desired rigidity. Previously, for low spring forces the small piston diameter of the liquid spring necessitated levering which limited its usefulness.

The simplified design of this new liquid spring permits the addition of the shock absorption feature to the Liqui Spring-Shok without complicated and critical metering while using the same components as the Liqui Spring by itself.

The Taylor Liqui Spring-Shok is only 7⅜" long by 1⅜" dia plus mounting stud. It delivers 8000 lbs of spring force with a 1300-lb preload developed by a 1" stroke and equals the combination of two 8" dia springs 7" long of 1" dia wire, plus two standard automobile shock absorbers each of the same diameter as the Liqui Spring-Shok. These liquid springs have been built to forces and range from miniatures to large sizes.

LARGER DIAMETERS . . . *Closer Tolerances?*

by Loyd C. Bigelow
Vice President
BOICE GAGES, INC.
Staatsburg, New York

PROGRESS HAS DEMANDED that larger product diameters be manufactured to closer and closer tolerances. In the last few years we have seen the ushering in of myriads of large diameters that have to be held to .002" or less.

Gaging, being a "necessary" but an unwelcome expense, for some years lingered behind in development. The flush-pin gage had grown up and was called upon to handle situations beyond its ability. Then too, there are various degrees of skill and judgment; the use of flush-pin gages requires a certain amount of each. The flush-pin gave nothing more than a good or bad knowledge of the part; and, today when the value of the quality control chart is well understood, this type of gage offers no data.

Although there are still many places where the flush-pin gage is the most sensible approach to the gaging problem, the indicator gage is enjoying increasingly widespread use. This is due largely to improved standardized fabrication methods that result in today's reduced gage cost. There was a certain transition period of education and try where men, confronted with decisions concerning the purchase of gages, leaned toward the flush-pin type. Perhaps you, too, can remember instances where the operator was expected to use gages requiring a feel of .001 or .002". In this day of visual-aids, the indicator gage speaks clearly for itself and accurately for the condition of the workpiece.

When considering a gage for a particular application, there are various points to be clarified in stating the problem. For instance: How many workpieces will the gage be expected to handle over its probable lifetime? What is the relationship of the diameter to be gaged to the surface upon which the gage will rest in gaging position.

What type of tip must the indicator use? If the surface of the material is of an abrading nature, perhaps a special carbide tip should be used. What is the allowable area upon which the gage indicator tip will be expected to take its reading? Is the surface of the part normal to the action of the indicator tip? Must the tip be of the retractable type in order that the gage can be placed in a gaging position.

What are the tolerances involved? This must be known in order to pick an indicator

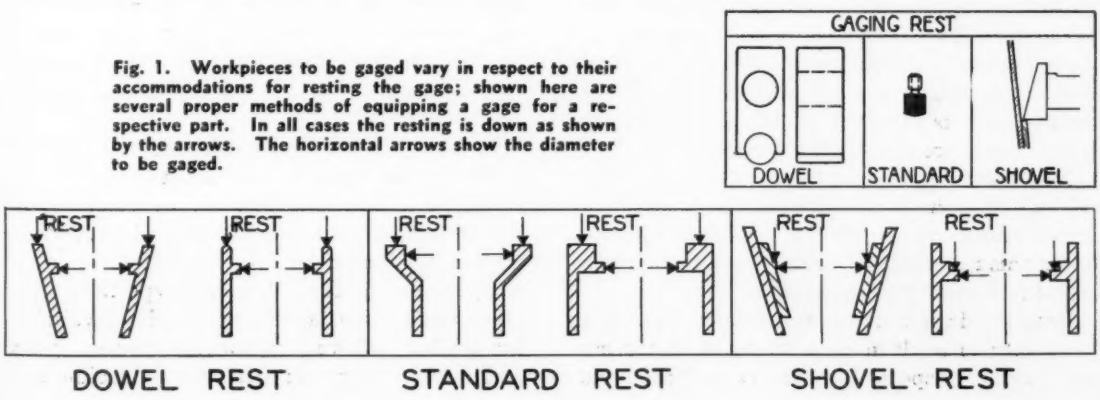


Fig. 1. Workpieces to be gaged vary in respect to their accommodations for resting the gage; shown here are several proper methods of equipping a gage for a respective part. In all cases the resting is down as shown by the arrows. The horizontal arrows show the diameter to be gaged.

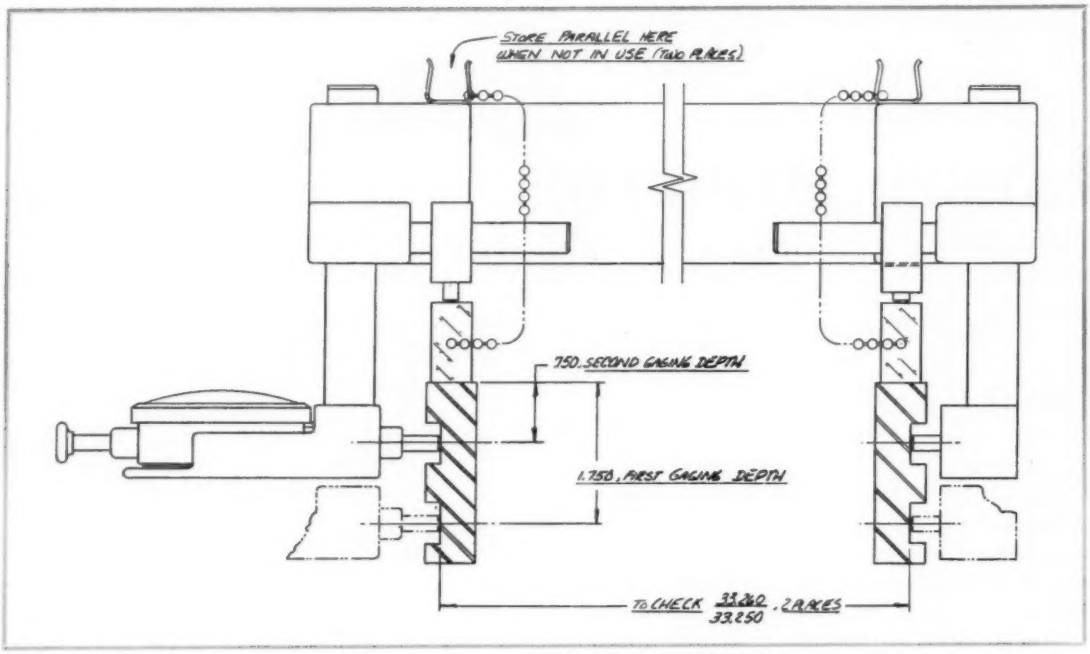

STORE PARALLEL HERE
WHEN NOT IN USE (TWO PLACES)
.750, SECOND GAGING DEPTH
1.750, FIRST GAGING DEPTH
TO CHECK 33.260 / 33.250 , 2 PLACES

Fig. 2. Several grooves in a part having identical diameters can be checked by the same gage; spacers may be used between the gage and work to position the indicator tip at the level of the groove being checked.

gage which will handle the range called for. Would tolerance hands on the dial be of any great help? What class of employee will be using the gage? Will he or she require a special face on the dial of the indicator (with color areas perhaps)?

Methods of Resting Gage on Work

Where the available work rest surface is a small area, such as the thin walled skirt seen in Figure 1, a dowel is usually used to support the gage on the work. This means the gage can be placed on the work with relative ease, and with assurance of its being properly located. Large gages, although they are light in comparison to a few years ago, should never be allowed to fall from their gaging position to some other position on the work. They are expensive, as are the parts being gaged, and surfaces could be marred if any bumping of gage and work should occur. Where the gage support area on the work is large enough for comfortable positioning of the gage, smaller pins or pads are advisable for rest points.

In special cases where the gage must be supported on a narrow ledge or in a recess, a shovel-nosed rest might be provided. In the event this rest surface is in a recess, the shovel-nosed rest could be made retractable.

Product design departments often are not permitted to work in close liaison with tooling and gaging. Especially in the case of products where space is critical and design is compact, access and clearance problems are frequent. Consequently, the rest feet, pads, bars and other means of supporting the gage on the work may have to be made retractable.

A gage is sometimes called upon to gage the diameters of several grooves in a large cylindrical surface, Figure 2. To do this your gage supplier provides spacer blocks, of respective dimensions, for use between the gage and the work to position the indicator tip in the proper groove. Special items of this sort are chained and nested on the gage when not in use to prevent their being lost.

Various Indicating Tips

The nature of the job dictates the type of indicator tip which will be used. If the surface to be indicated is normal to the indicator action, a regular tip will probably be used. Regular tips are furnished with the gage unless a special is called for by order or is apparently necessary.

In the case where the surface to be indicated is not normal to the action of the indicator tip, a ball tip is in order. In some instances where the allowable land for indicating is not large enough for the use of a regular or ball type tip without interference, a shovel type tip is recommended. Special tips are readily available for gaging grooves, raceways, splines, gears and many other odd surfaces. Carbide tips

can be had to assure long run gaging conditions of accuracy and long wear. See Figure 3 for illustrations of a few of the more common types of tips.

Gage Construction

Boice Manufacturing Co., due to its methods of gage fabrication, is able to offer gages that give exceptional performance. Due to the selection of specific raw material for component parts and to the firm's experience in processing these in respect to stress-relief, "Boice" gages encompass a minimum of error within themselves.

AGD standard indicator design is employed for user convenience, interchangeability, and accuracy in millionths. AGD standard indicators for the most part are available "right off the shelf".

Basic gages are built in progressive sizes, each size being adjustable to cover its respective range; this feature precludes the possibility of a gage being obsoleted in the event of an engineering change. Not only are they adjustable to diameter changes, but if there should be an engineering change in the distance of the rest surface of the gage to the indicator tip, this too is adjustable. Remember the old cry? "They pulled an engineering change on us. We haven't even used our gages and already they are obsolete." This is seldom heard today. Gage components attached to the basic beam construction are for the most part interchangeable, thereby reducing the factor of gage obsolescence.

Light in weight and uncomplicated in design, Figure 4, these gages permit "on the machine" checking which might not be a possibility were the gages of a heavy or "fussy" construction.

Inexpensive Masters

All gages must be "zeroed in" before use. They must be "set", in other words, so that the indicator dial will read zero when the dimension to be checked is on the mean. This is also true for subsequent employment — the gage

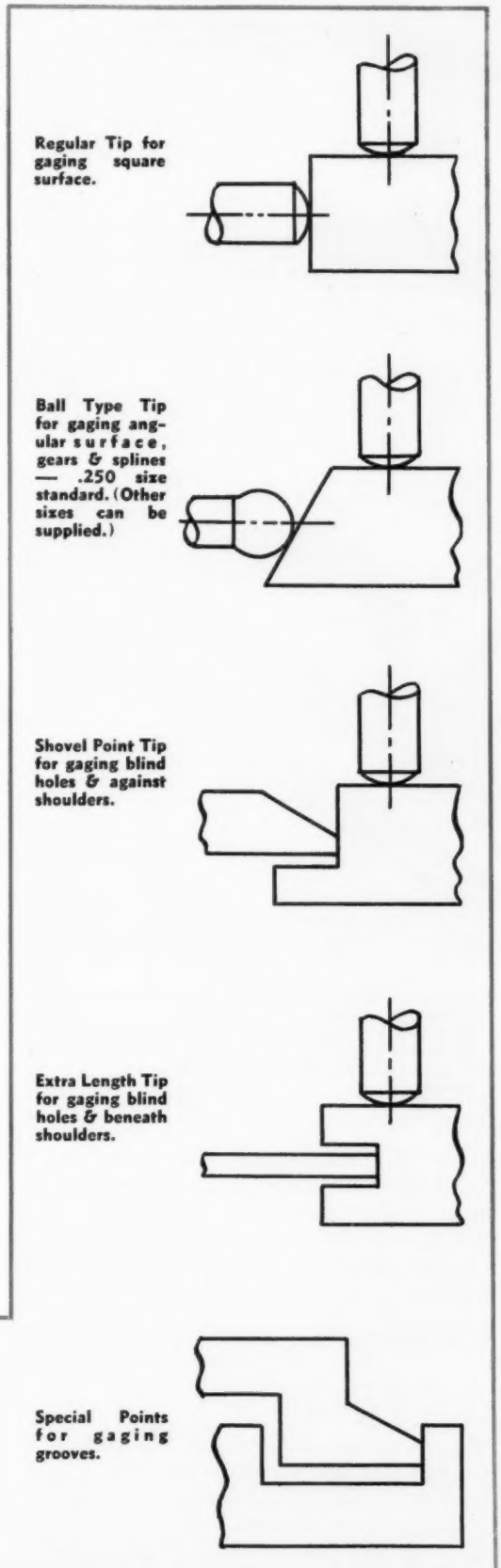
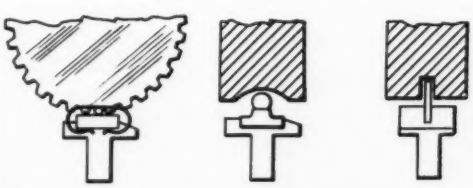
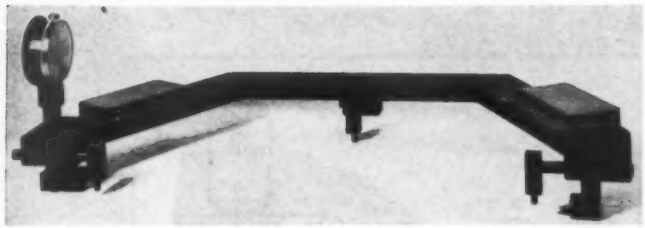
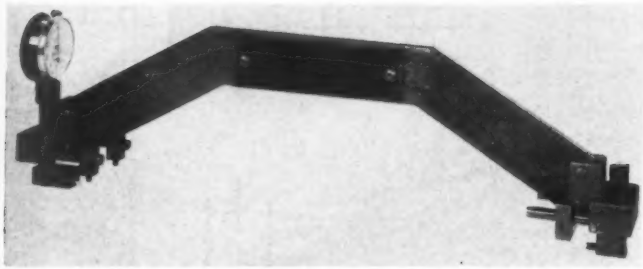

Regular Tip for gaging square surface.
Ball Type Tip for gaging angular surface, gears & splines — .250 size standard. (Other sizes can be supplied.)
Shovel Point Tip for gaging blind holes & against shoulders.
Extra Length Tip for gaging blind holes & beneath shoulders.
Special Points for gaging grooves.

Fig. 3. Various indicator tips are available to suit the specific job.

SPECIAL TIPS







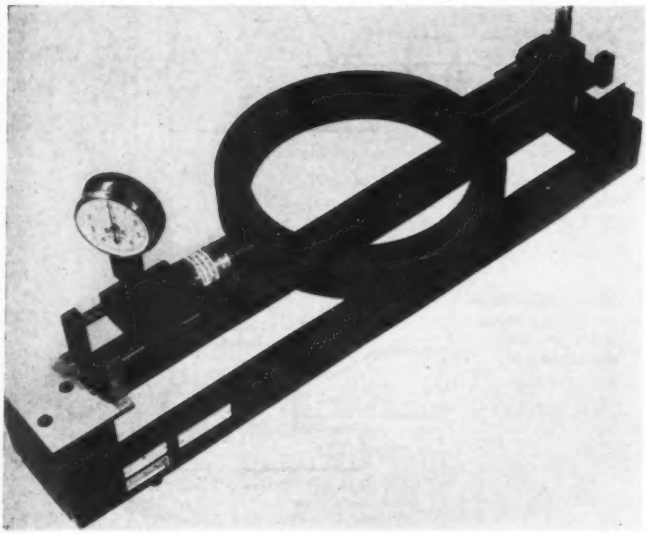


Fig. 4. In instances where the part offers obstructions to the plain beam-type of gage, other gages such as those pictured above are stocked or designed to fit the peculiarity involved. The gage above with a circular frame for clearing the obstruction is shown in its set-master.

should be checked against its master, Figure 5, as often as is found to be necessary. The masters, also furnished by "Boice", are set by gage blocks; in the case where indicating is to a surface other than normal to the line of the indicator action, a conversion formula, below,

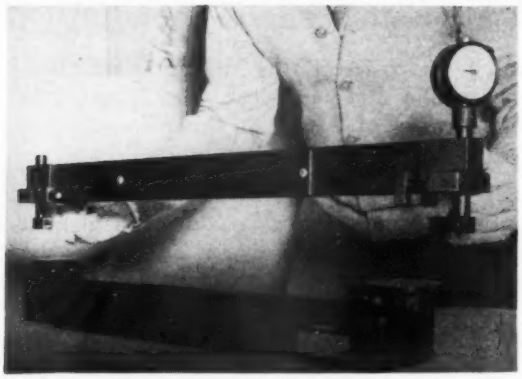


Fig. 5. A gage is shown being placed in its master to recheck the "zero setting".

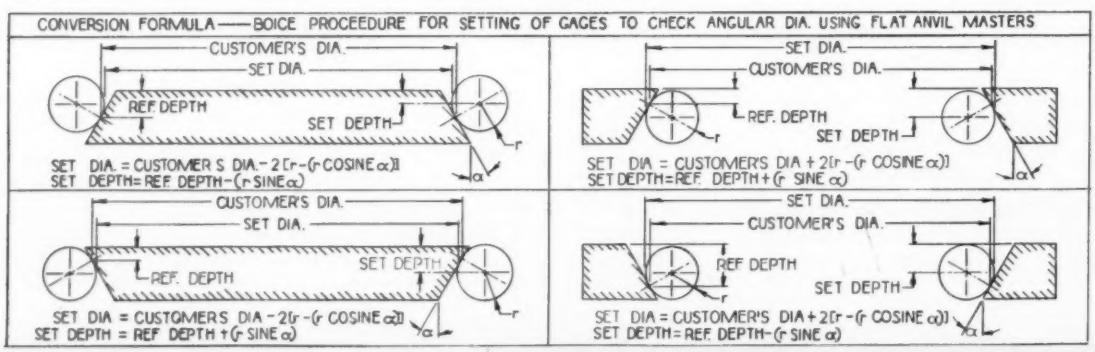
is easily applied to arrive at the gage block setting.

At one time all set-masters were relatively small (due to smaller diameters being checked). Sufficient was the ring type or disc; but for today's larger diameters, fixed set-masters are usually not practical. Enjoying increasingly widespread use are the fixed-adjustable masters, handy and versatile. It is interesting to note that these adjustable masters can be set from the gage. The gage of course is first set to zero by the gage block method.

As an aid in ordering, a marked part print or transparency sheet is helpful. Sometimes marked prints cannot be circulated due to the secret nature of the work. If this be the case, a brief stylized outline will do the job; obstructions which might influence the gage selection and any other pertinent information can be included.

Of great help to your engineering department are templates of the various gage types available. In many cases these templates, which can be slipped under the tracing, readily show the particular gage necessary for the job. When desirable, the same template can be used for easy transfer of the gage outline.

Selection of an adjustable gage from a standard line permits its cost to be amortized over several assignments. This being true, the purchase of what might seem to be an exceptionally large gage should not be arrested because it is being considered for a short run. Larger diameters are here to stay and are just in their infancy. ΩΩ


CONVERSION FORMULA — BOICE PROCEEDURE FOR SETTING OF GAGES TO CHECK ANGULAR DIA. USING FLAT ANVIL MASTERS
CUSTOMER'S DIA.
SET DIA.
REF. DEPTH
SET DEPTH
r
α
SET DIA. = CUSTOMER S DIA. - 2 [r - (r COSINE α)]
SET DEPTH = REF. DEPTH - (r SINE α)
SET DIA.
CUSTOMER'S DIA.
REF. DEPTH
SET DEPTH
r
α
SET DIA = CUSTOMER'S DIA + 2[r - (r COSINE α)]
SET DEPTH = REF. DEPTH + (r SINE α)
CUSTOMER'S DIA.
SET DIA.
REF. DEPTH
SET DEPTH
r
α
SET DIA = CUSTOMER'S DIA - 2[r - (r COSINE α)]
SET DEPTH = REF. DEPTH + (r SINE α)
SET DIA.
CUSTOMER'S DIA.
REF DEPTH
SET DEPTH
r
α
SET DIA = CUSTOMER'S DIA + 2[r - (r COSINE α)]
SET DEPTH = REF. DEPTH - (r SINE α)

QUALITY CONTROL OF CEMENTED CARBIDES

by W. C. Seitz
Manager, Research and Development

and J. H. Powers
Superintendent, X-ray and Metallography

FIRTH-LOACH METALS, INC.
McKeesport, Penna.

QUALITY OF SINTERED CARBIDES is uppermost in the minds of all of us at Firth-Loach Metals, Inc. We did not compose the following definition of Quality but we try to live up to it:

> "Quality is never accidental; it is always the result of high intention, sincere effort, intelligent direction and skillful execution. It represents the wise choice of many alternatives and accumulative experience of many masters of craftsmanship. Quality also marks the search for an ideal after necessity has been satisfied and the mere usefulness achieved."

In an effort to achieve the above, high quality raw materials are specified to our suppliers. The various types of tungsten require a definite particle size, shape and distribution and high purity. The particle size specifications are necessary to produce the desired physical properties in our final grades. Rigid standards are also placed on the titanium and tantalum carbides and cobalt, as well as acetone, naphtha, paraffin and all the various materials used in making sintered carbides.

A three months' supply of the basic raw materials is always on order. Before shipment from the supplier, a test batch is sent to us to be processed to the final sintered carbide using our standard production methods. This material must meet our specifications at each stage of our process before it is approved for shipment to our plant. This is necessary since materials from different suppliers do not always produce the same end result. If inferior materials are used to produce cemented carbides, the end product will not have the high quality and uniformity which we desire.

The main steps in the manufacture of cemented tungsten carbide are:

1. Processing of tungsten metal powder to tungsten carbide.
2. The pre-forming of alloys or mixed crystals of tungsten carbide, titanium carbide and tantalum carbide in various combinations.
3. Manufacture of the final composition.
4. Inspection of finished product.

At every step in the process, controls have been set up and are rigidly followed for each production lot.

Processing of Tungsten Metal Powder

The first step in the process is the preparation of tungsten carbide. An analysis is made for the carbon content of the tungsten plus carbon mixture after ball milling. This is accomplished by the use of a Combustron, illustrated in Figure 1. A weighed sample of the powder is placed in a covered ceramic boat along with accelerator materials and ignited in an induction coil.

The gases evolved, after passing through a train which removes moisture and sulphur, are collected in a weighed container. The carbon content is calculated from the difference in weight for this container before and after the gas is collected. For various types of tungsten, a range of carbon has been established and is maintained by this control.

The tungsten plus carbon mixture is then heated to form tungsten carbide. The temperature and time are held within narrow limits. After heating, the tungsten carbide is crushed and ball milled. A sample is analyzed for total carbon by the same procedure as for the tungsten plus carbon mixture. The free

Fig. 1. The Combustron is used to determine carbon content of the tungsten plus carbon mixture after ball milling.

carbon content is determined since it must be held to a minimum. This sample is also analyzed for complete carburization by the use of an X-ray Spectrometer, illustrated in Figure 2.

A powder compact is subjected to the x-ray beam which is diffracted from the various crystal planes of the sample. The impulses are picked up by a Geiger Counter tube and relayed through an electronic circuit. A pattern of these impulses is recorded automatically on a chart. This type of analysis, which gives the exact state of the material, will indicate whether the tungsten is thoroughly carburized. If it is not, a pattern of the lower form of tungsten carbide, W_2C, which contains approximately one-half the amount of carbon of tungsten carbide, will be present.

There is also the possibility of having tungsten metal in the powder which will be shown on the chart. If complete carburization has not been obtained, the material is then adjusted and re-processed. If the material is not re-processed, the W_2C and tungsten will react with cobalt during final sintering of the grade to produce undesirable eta phase. This phase causes brittleness and poor resistance to thermal shock although it may only be present in very small amounts. The average particle size of the tungsten carbide is measured by the use

Fig. 2. In the X-ray Spectrometer, the beam penetrates to and is diffracted by the internal crystal planes of the sample powder compact. The resultant pattern is automatically charted.

of a Fisher Sub-Sieve Sizer. This does not determine the particle distribution but does give a relative value for each type and batch of tungsten carbide. Each batch is also tested for volume and apparent density.

The Pre-Forming of Alloys

The pre-formed alloys or mixed crystals of tungsten carbide, titanium carbide and tantalum carbide are all analyzed for total and free carbon content, complete solution and particle size. The carbon and particle size are determined by the same method as for the tungsten carbide previously mentioned. The X-ray Spectrometer is used for determining the degree of solution.

A powdered compact of each lot is subjected to the x-ray beam as described for tungsten carbide samples. By solution, we mean the dissolving of one carbide by the other. For example, when tungsten carbide and titanium carbide are heated to the proper temperature under controlled atmospheres, the tungsten carbide atoms are absorbed into the structure of the titanium carbide. A mechanical mixture of these two carbides will produce two patterns on the x-ray chart, one of titanium carbide and one of tungsten carbide.

After heating, if complete solution has been obtained only one pattern will appear on the chart, that of the dissolving material which in this case is titanium carbide. If solution is incomplete, the pattern of tungsten carbide as well as that of titanium carbide will be present. Re-processing will then be necessary since the physical properties to our end product are dependent upon the degree of solution of these carbides.

Manufacture of the Final Composition

After the raw materials and carbide powders are approved, the final composition is prepared. From each batch, test pieces before and after the paraffining operation are made for a check on hardness, specific gravity, transverse rupture strength, fracture and metallographic examination.

The hardness of cemented carbide compositions is usually measured by Rockwell testing on the "A" scale, although the "C" scale is used on the higher binder compositions. Actually, this test is no measure of the hardness of the individual carbide ingredients making up the majority of the composition but rather a test on the composite including the binder metal. The individual carbide particles are much harder than is indicated by the test, being very close to diamond in scratch hardness testing. A narrow range of hardness is specified for each of our compositions.

. . . Continued on Page 104

Part II - The Job of The Quality Control Department

SELLING MANAGEMENT A QUALITY CONTROL PROGRAM

by Ray F. Engelgau
Director of Quality Control
MUELLER BRASS COMPANY
Port Huron, Michigan
and
Harmon S. Bayer
Quality Control Consultant
Detroit, Michigan

BASICALLY THE JOB OF THE quality control department is to organize so that it is able to point out where quality problems originate and who is the responsible party. The quality control department then assures that the responsible party is required to clean up the situation causing bad quality.

In order to do this the quality control department must first determine where to work. One of the first things a quality control department must learn is to resist the common tendency of every department in the plant to tell the quality control department where to work, what problems are important, etc. This can ruin a quality control department in its infancy.

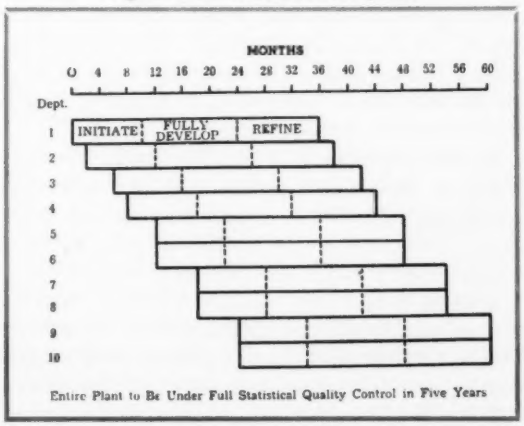
It is important that, from the start, the quality control department pick its own spots. It must do so based upon the availability of people, the level of their training at that time, the potential savings which can be gained, and many other factors. Beware of the trap many departments will set based upon their eagerness to get anyone to work on what they consider is the only problem in the plant—their own.

It will take tact and diplomacy to put off the well-meant pressures of various departments, but quality control must determine its own courses of action based upon its present know-how and the goals that must be achieved.

After you have determined where to work, the next thing that must be determined is what is required. When quality control enters the picture on any operation, in many cases it finds there are no specifications or standards available. In other cases they are entirely unrealistic. Whatever the case, quality control must find out what is required by the various departments which set standards and not blindly require compliance to obviously impractical and unrealistic standards. It is their job to determine if they are reasonable, economical, and competitive goals.

Quality control should cooperate with engineering and technical departments to obtain practical standards. We find it is necessary that those departments set specifications; it is not the job of quality control. However, in many cases unreasonable and impractical limits have become historically existent on the blueprints of the company for years. It is the

Fig. 2. Time table for the plant.



Entire Plant to Be Under Full Statistical Quality Control in Five Years

Presented at the 10th Annual Michigan Forum of the Michigan section of the American Society for Quality Control, September 17, 1955.

job of the quality control department to expose these impractical standards and to provide statistical studies to the specifications engineers which give the quality capabilities of the processes and equipment presently available.

The engineers must then analyze specifications in line with reasonable machine and process capabilities. They should compare the studies with their own data on strength of ma-

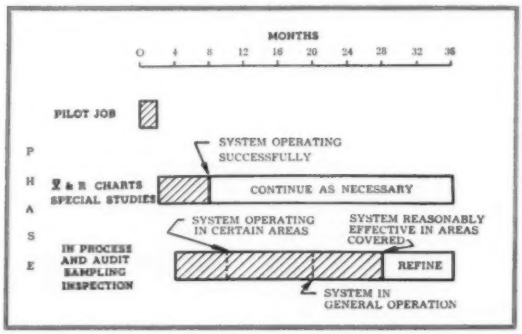

MONTHS
0 4 8 12 16 20 24 28 32 36
PILOT JOB
PHASE
SYSTEM OPERATING SUCCESSFULLY
X & R CHARTS SPECIAL STUDIES
CONTINUE AS NECESSARY
SYSTEM OPERATING IN CERTAIN AREAS
SYSTEM REASONABLY EFFECTIVE IN AREAS COVERED
IN PROCESS AND AUDIT SAMPLING INSPECTION
REFINE
SYSTEM IN GENERAL OPERATION

Fig. 3. Time table for a department.

terials, etc. In many cases when such studies are made, much wider specifications are allowed.

The next step for the quality control program in any problem is to determine what to measure. This entails a decision as to the type of gages to use. Statistical quality control requires changing from the old go and no-go system gages to the system of indicating gages. Mueller Brass Company sees this as preferable on two counts. First, dimensional control under statistical procedures needs this kind of gage. However, another fact sometimes overlooked by quality control people is that in the long run this is a much more economic type of gaging system.

It is true that go and no-go types of gages are cheaper, but one indicating gage will substitute for a large number of go and no-go gages and will outwear many of them. Also we might note that checking with indicating gages is much faster than go and no-go gaging on the average. This gives the operator much more time to check his job.

Another responsibility of the quality control department is to cooperate with the methods department to assure practical methods and compliance to these methods. In many cases recorded methods procedures are not available to production people. This results in a variety of methods performed on the same operation. Shifts, operators, and supervision vary from day to day. Of course, this has a marked detrimental effect on quality.

Another very important point is that sometimes methods people set up certain procedures based upon the desire for high production without taking into consideration the adverse effect on quality. It is the quality control department's responsibility to point this out and obtain changes so that quality as well as quantity are written into procedures. The quality control department should throw its resources into cooperation with the methods people to assure that practical methods are determined and complied with.

In order for quality control to do its job, the foregoing factors must be taken care of, but quality control's main job revolves around four major services.

First, it must control the quality of received material. Receiving inspection must be organized in a logical fashion so that each item received from each vendor is kept in a separate history file. Each lot should be inspected by statistical acceptance sampling procedures. The characteristics on any one item to be inspected should be organized and recorded on an inspection instruction sheet so that each time a lot of a particular part is inspected, it will be inspected in the same manner.

Records are kept and lots rejected by the sampling plan are returned to the vendor for sorting, except in unusual cases where the stock is needed. In that case, the lot should be sorted and adjustments made with the vendor which may include charging him for the inspection time, etc. A history is kept of the individual parts and in the event a particular item shows a questionable history we send the information to purchasing for their action. We are also looking forward to the day when our vendors will be able to certify their shipments based upon their ability to produce under statistical quality control conditions and the quality history as shown by our receiving records.

The second major job of the quality control department is the control of materials in process. Troublesome dimensional characteristics are controlled through a system of average and range charts ($\overline{X}$ and R) placed at the troublesome operations. Incidentally, Mueller Brass Company believes in a system of so called modified statistical limits. These use the full principles of statistical quality control but also allow the full width of the specification. We found that $\overline{X}$ and R charts are exceedingly effective in controlling these troublesome dimensions.

However, we have found that it takes strong management action to insist upon compliance

to the charts. In the plant when $\overline{X}$ and R charts are out of control, the job must shut down and adjustments be made. Without this rigid rule, we find the charts are not and cannot be expected to be effective. We regret that we have never been able to convince some people that $\overline{X}$ and R chart limits do not take away part of the specification. This is a disadvantage since it helps to keep alive some resentment toward the program. However we feel that the tremendous advantages of these charts outweigh this disadvantage.

In addition to these $\overline{X}$ and R charts, special studies are carried out to aid various departments who cooperate with the quality control department in gaining quality goals. Capability analyses of machines and equipment are provided for the use of maintenance, production, engineering and other departments. Information on capabilities versus specifications are provided to the specification engineer. Advanced techniques such as correlation, analysis of variance, and other designed experiment techniques are used whenever necessary to provide information relative to quality problems. In each case when the study has been made the quality control department follows through to get corrective action from the cooperating departments involved.

Using $\overline{X}$ and R charts, special studies. and the other methods we have just outlined will not give full process control. Actually these will only control a few of the necessary characteristics that must be controlled on any one operation. In fact, Mueller Brass Company regards these techniques as quality control's service to production departments and other departments to aid them in controlling difficult situations.

On the other hand, quality control must protect the customer and management by seeing that only good products (in general) get out and that bad products (in general) are rejected for action. In order to do this Mueller Brass Company found it necessary to establish in-process acceptance sampling plans.

A system is used in which the material at each operation is inspected for those quality characteristics affected by that operation. No stock is allowed to move from one operation to another without passing a statistically designed sampling plan which gives the quality level desired. Quality characteristics desired at any operation are posted, and a sample is taken by the inspector based upon a systematized statistical sampling plan.

By this method, defective material is prevented from moving to the next operation. However, this plan is not effective unless the rejected lots are returned to production personnel for sorting, repair, or any other action they deem necessary. The quality control department will only accept lots that meet the desired quality level. It has been found that these teeth must be put into the plan or the production department merely carries on as before. A few well chosen rejections really puts them on their toes, and they begin to build quality into their products rather than expect the inspection department to sort out the defectives.

The third major job of the quality control department is to provide a system of accepting the product when it is finished. Formerly, many companies felt that it was necessary to maintain 100% inspection at the end of the line. It has been proven to Mueller Brass Company management's satisfaction that this was no protection at all. They have found that a statistically designed sampling plan which audits the quality at the end of the line and sends the rejected lots back to the production department involved for their action has the desired effect of causing production to think twice about allowing defective material to continue to be built.

As in-process sampling inspection systems take hold, the audit (or final) sampling inspection system is not always necessary and this can be curtailed. However it is always necessary to have an audit team which only checks occasionally but often enough to keep the process control system on its toes.

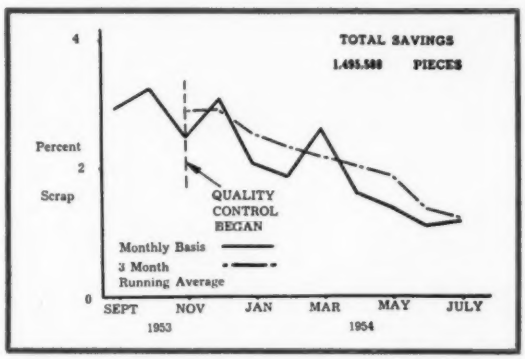


Fig. 4. Improvement in scrap — Brass Shop and Automatics.

The fourth major job of the quality control department is to provide a method of recording past errors and paving the way for correcting future production. Catching today's errors is only one part of the job. One of the most important responsibilities of a quality control department is to constantly study today's mistakes to prevent tomorrow's problems. A system of coordination with design, development, research, maintenance, and other departments

must be established so that these departments will change characteristics of future production to prevent recurrence of the problems which have been exposed by quality control data.

We have spoken about certain systems, both organizational and statistical. However, please note that systems don't solve problems. It takes action by production, engineering, maintenance, design, or any other department responsible for the quality problem. Without this action, no quality control department can effectively function. This is the responsibility of the quality control department — to see that this action is taken. Also it is the responsibility of top management to back the quality control department to the hilt on this score.

Organizing and Spreading

If you were to think of your plant, you might ask "How do we organize?" It seems like an endless and difficult job. Like anything else, it must be done slowly, logically and one piece at a time. It was necessary to divide the Mueller Brass Company plant into ten logical subdivisions. Each of these subdivisions is handled as if it were a different plant and the entire system is developed in this area independent of the other areas, Figure 2. As we pointed out before, a quality control technician is appointed to supervise the program in each of these areas while a quality control engineer may be responsible for two or more. The program in each subdivision is instituted depending upon the availability of engineers and technicians and the levels of training which the personnel have attained.

Fig. 5. Improvement in repairs — Brass Shop and Automatics.

For all intents and purposes the timing within each subdivision is approximately the same, but we do find that those subdivisions that start late don't take quite as much overall time as those that start in the beginning. The late starters benefit from the experience of the entire organization and the "advertising" that the program gets from the other departments.

In general it takes about two to three years of concentrated development in any one department. This timetable is stated only for the cases of having a consultant available or comparable inside know-how. We have included a timetable, Figure 3, which shows the approximate scheduling in one department. There is nothing sacred about this particular schedule; The Mueller Brass Company program has varied in some of our departments. The order of instituting various phases is sometimes switched. Please consider this only as a typical timetable. The pilot job involves about six to eight weeks. The $\bar{X}$ and R chart development period takes about six months and after development the program proceeds on a continuing basis.

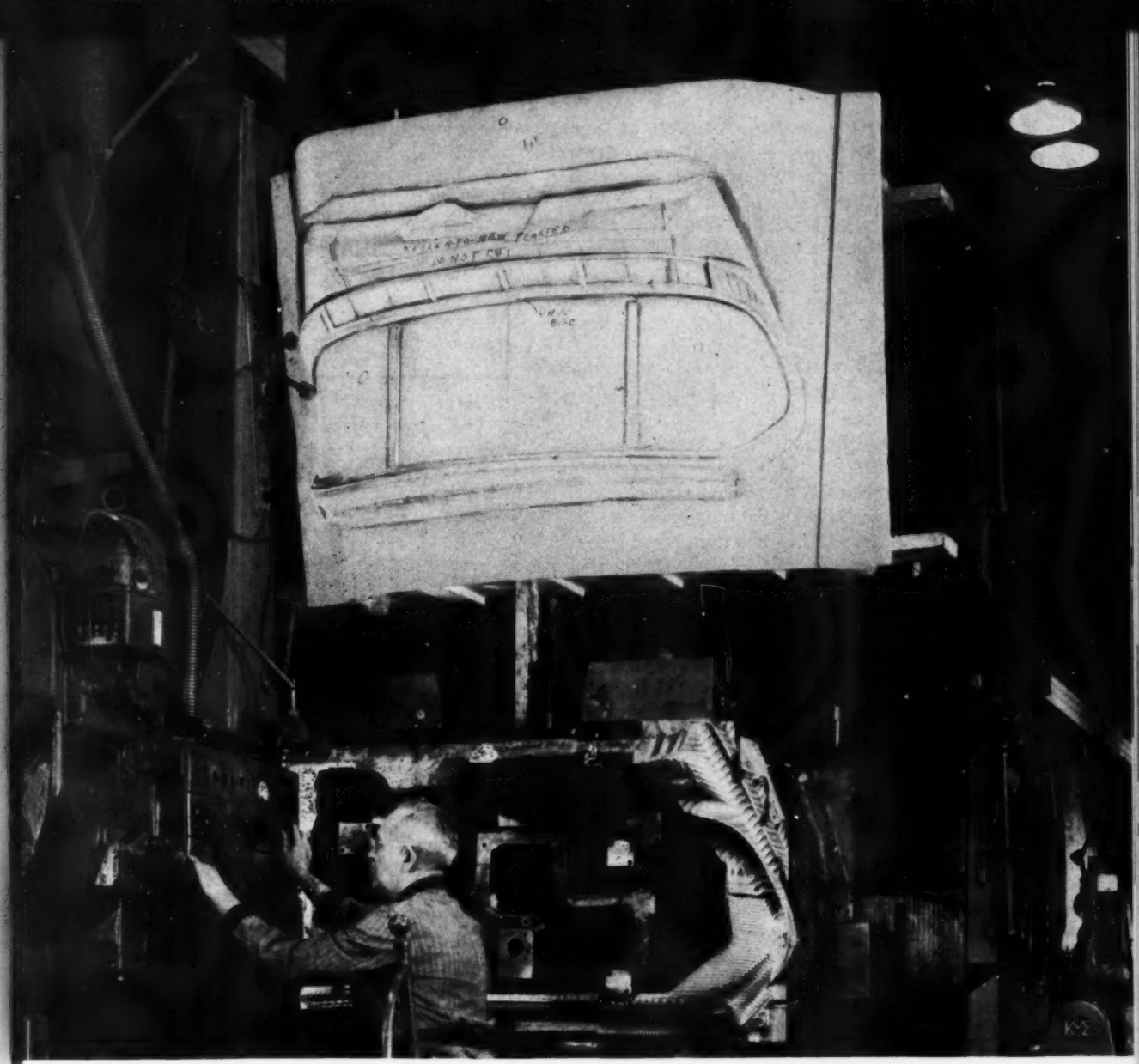
Incidentally, this phase is most important in that it trains the quality control department personnel in the know-how of that particular area so that they can handle their end of the problems in discussions, etc. The in-process acceptance sampling system and the audit systems take about one to two years in development to fairly effective levels. Of course, the audit systems expand and contract based upon the development of in-process sampling systems. During the last year, the refinement of all of these separate systems takes place.

In addition, we have found that we then enter new phases of quality control in which many significant and substantial benefits to the entire organization begin to be apparent. This is due to the effect of the integration of the program with the various service organizations of the company and the resultant interplay of ideas and communications. Many of these benefits will be listed later.

In general the plant schedule for a quality control system in the entire plant was set as follows:

An effective functioning organization which controls quality, cuts scrap, repair, inspection labor, and customer complaints to a reasonable economic level takes about three to five years. Again we say this is with the services of a consultant. We would assume that this time would be doubled without a consultant or the equivalent in know-how available within your organization.

A fully effective organization servicing all departments with statistical services, cost reduction programs, etc., will take approximately five to ten years. Again this timetable would be modified from your point of view depending upon whether you seek or have available expert advice.



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Incidentally, we may seem ahead of ourselves as you probably realize Mueller Brass Company has not gone through all of the steps listed in the timetable in all departments. However, every goal to date has been met and sometimes surpassed according to the original timetable. There is no reason to believe that they will not obtain the same benefits that other companies have gained, and upon whose experience we based our timetables.

However, it was found that the cost-saving benefits of the program began to be apparent almost immediately. From six weeks after the start of the program it has paid its entire way and saved the company considerable money. In addition, the scrap, rework, inspection labor and customer complaint reports in those areas where the program is effective, have shown steady and consistent decline. Again, this timetable must be modified depending upon whether you seek or have expert advice available to your organization.

Side Benefits

It has been found, as we stated before, that many substantial benefits accrue from the quality control program that are not directly connected with departmental responsibilities. As an example a study was made of some of the standard items which proved that the tolerances for the products were unrealistic, uneconomical and much tighter than those of competitors. The specification department changed these tolerances to more realistic aspects and they have noted cost savings and much less organizational problems in these areas.

Maintenance, design, sales, cost analysis, engineering, office departments and many other departments are beginning to come to quality control in an ever increasing pace for information to help them make more logical and economical decisions. Providing this kind of service is one of the most significant contributions which the quality control is making and is helping us sell the quality control department to all levels of management. Incidentally, top management doesn't need too much selling on the benefits of this kind of activity.

Reports to Management

We would like to quote from a presentation which was made to top management after the quality control program had been in operation about nine months. It showed that in only two departments, the following progress had been made during that nine month period:

Scrap, Figure 4, was reduced from approximately 3.0% to 1.0% resulting in a savings of approximately a million and a half pieces.

Repair, Figure 5, was reduced from approximately 1.5% to less than 1.0% resulting in a savings of two hundred thousand pieces.

Inspection man-hours in these departments, Figure 6, was reduced from 17 man-hours of inspection per 10,000 pcs produced to approximately 7 man-hours of inspection labor per 10,000 pcs produced. Total savings in labor amounted to over $100,000.

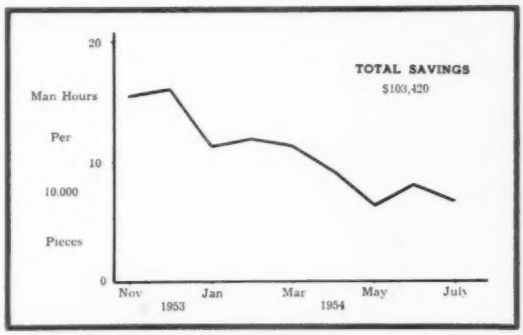


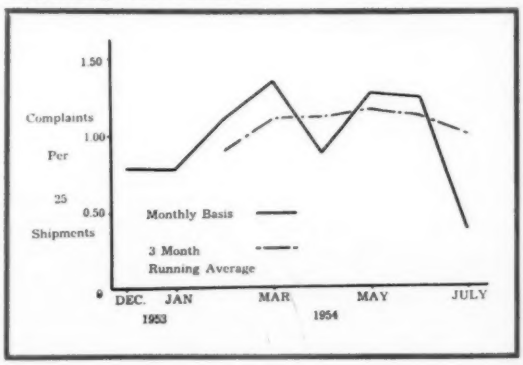
Fig. 6. Reduction in inspection man-hours (per 10,000 pcs. produced) — Brass Shop and Automatics.

A study of the customer complaints during this period, Figure 7, showed that we were holding our own in this particular phase. Subsequent reports have shown a definite downward trend.

In the final analysis it indicated that if the entire cost of the quality control program up to that time was balanced against the savings made in only two departments there was an overall savings of at least $100,000 for the company in nine months, Figure 8. Subsequent reports have shown this to be increasing steadily as other departments take hold.

We can't emphasize too strongly that one of the ways to sell your management is in this type of reporting. Month by month the quality control department points to progress made in the various departments whenever possible,

Fig. 7. Customer complaints (per 25 shipments) — Brass Shop and Automatics.

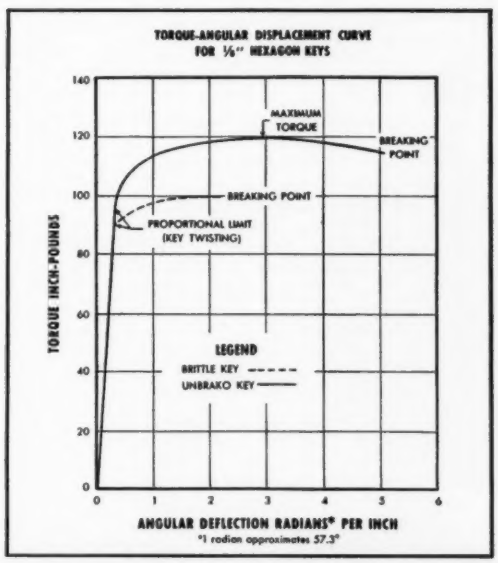


Tighten socket screws tighter, more safely with High-Titan UNBRAKO hex keys

High-Titan UNBRAKO socket screw keys are stronger than ordinary keys. They are made of selected, accurately sized hex stock, with carefully formed 90° bends that won't break. The ends are cut square to engage sockets full depth for highest tightening power. These keys are heat treated uniformly to give hardness and ductility clear through without brittleness or decarburization.

All this results in many advantages. You can torque up a screw tighter with an UNBRAKO than any other key. Performance is consistent—you can apply the same tightening torque every time. Screw sockets won't ream, and the keys won't wear excessively. If you should apply too much torque, a High-Titan would break, but shear off clean and even with the top of the socket—not at the bend—and without leaving jagged exposed edges to gash your hands.

One High-Titan hex key is included with each standard package of UNBRAKO socket screws. High-Titans are also available as sets in convenient, durable plastic key folds, and in bulk. Your authorized industrial distributor carries them in stock. See him today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 36, Pa.



THESE CURVES SHOW THE DIFFERENCE between an UNBRAKO hex key and an ordinary key. The UNBRAKO withstands more tightening torque, twists through 180° without breaking, then shears off even with the top of the screw socket. Ordinary keys snap off suddenly at the bend.

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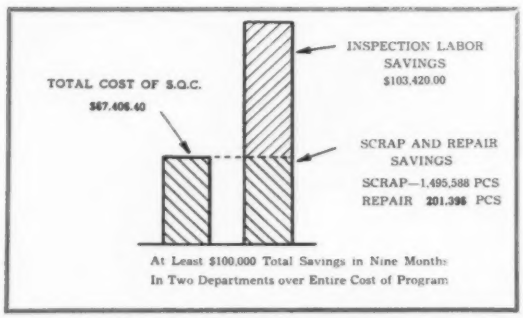


Fig. 8. Statistical Quality Control Program (Costs vs. Savings).

turning it into money figures so that top management realizes that not only is the quality of the product improving but the program is saving them a considerable amount of money as it develops. These kinds of reports to top management are absolutely necessary to any program as it continues to demand personnel and equipment to carry out its responsibility. The way is not smooth but it's worth it.

We have shown you a number of things today but we don't want you to get the idea from this discussion that the way is smooth and easy. It takes considerable determination, patience, and intestinal fortitude to develop this program. However, if you keep your eye on the long run goal, when you achieve it we are sure you will look back and say it was worth every effort you gave it. ΩΩ

Throw-Away Insert Milling Cutters Cut Tool Cost

A revolutionary new approach to carbide milling has been developed in the form of throw-away insert milling cutters. These cutters, which like throw-away insert holders never require sharpening, are designed to handle the majority of all rough and finish milling operations on cast iron and steel.

Employing low-cost disposable Wessonmetal blades which have eight quickly indexable cutting edges, the Wesson throw-away insert milling cutters developed by Wesson Company, 1220 Woodward Heights Blvd., Detroit 20, provide a broad range of advances in milling practices. Following are some of the characteristics:

1. High Speed Milling—The design of the throw-away insert milling cutter permits high speed milling at high feeds. Negative radial and axial rake combinations provide ample clearance and give eight cutting edges on square blades.
2. Low Tool Cost—Blade cost is as little as 17c/cutting edge. By elimination of grinding, cost per piece is lower.
3. Quick Setup — Elimination of grinding and any need for complicated blade adjustment make rapid blade indexing possible resulting in drastic reduction in setup time.
4. Inventory Reduction — Since cutters do not have to go back to cutter grind for re-sharpening, excess reserve inventory of cutter bodies is not required. Cutters, in some cases, can be maintained right at the machine. Efficient milling of both cast iron and steel possible with the same cutter body using different carbide grades also reduces inventory costs.
5. Standard Drive — In addition to their many advantages, Wesson throw-away insert milling cutters can be used with present adapters and machines eliminating special conversion cost.

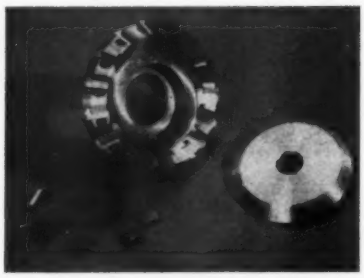


Fig. 1. Throw-away insert milling cutters by Wesson never require blade sharpening. High rigidity achieved in the Wesson design enables the blades to take a sizeable cut despite the relative thinness of the blades.

Uniform and positive blade location is achieved by placing a simple ring gage against the cutter face. Blades are then aligned by making contact with the gage and locked in position by taking up on the socket head screw.

For the present Wesson is engineering these cutters to meet the requirements of individual jobs.

Typical Operations

Performance of Wessons throw-away insert milling cutters shows they have the ability to take sizeable bites of metal while producing an excellent surface finish. On one job, for example, a 4" dia cutter was used to take a roughing cut on SAE 1095 hardened steel tool holder shanks at 1000 rpm and 1048 sfm. Feed rate was 52 ipm with a .125" depth of cut. Not only was production increased over previous methods, but grinding time was materially reduced by the excellent surface finish obtained.

On another job these cutters were used to machine the ends of structural steel I-beams at 1200 rpm and 1250 sfm. Feed rate was 40 ipm with a .125" depth of cut. Despite considerable vibration of the I-beam while milling the web, exceptionally good blade life was experienced due to the rigid support given to the throw-away insert blades in the Wesson milling cutter.

In machining a SAE 1020 steel slab, a 12-blade throw-away insert cutter did the job at 1290 rpm and 1250 sfm. Depth of cut was .187" at a feed of 30 ipm. These jobs, while they do not give the full work range possible with Wesson throw-away insert milling cutters, indicate that the new milling cutter design can be used to advantage on numerous applications.

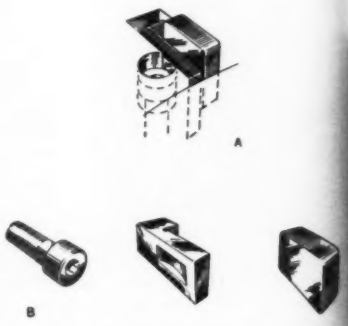
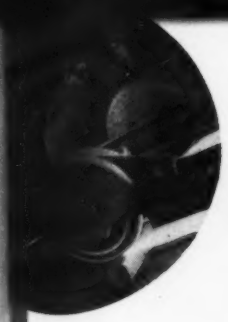
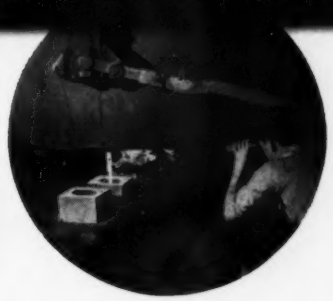


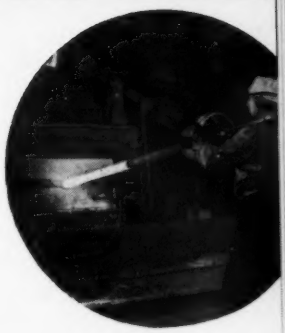
Fig. 2. Line drawing showing assembled view (A) of throw-away insert milling cutter blade, locking wedge, and socket screw. Rigidity is achieved by full face bearing of the hardened steel locking wedge on the solid carbide tip.

Disassembled view (B) of the throw-away parts. Head of screw fits into groove of wedge locking it firmly against the blade when screw is tightened.



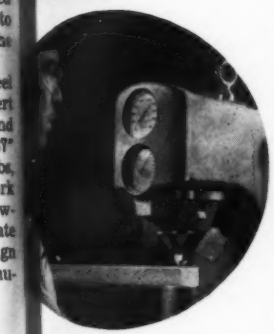


How Men and Controls Protect Industry's Confidence in *Carpenter* High Speed Steels



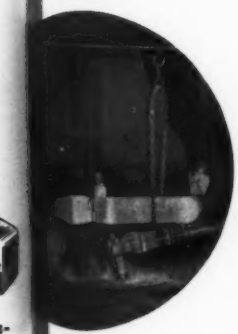
The *performance* you get from high speed steels is directly related to *how* they are produced. As a specialty mill where quality overshadows tonnage . . . and all operations are set to this standard . . . Carpenter devotes the time and attention required to produce high speed steels of the finest quality.

From careful scrap purchasing to guaranteed analysis, and painstaking time and temperature checks during melting . . . through rigid controls of bar reduction in rolling, and many other quality tests at all steps . . . these are the "indispensables" that have enabled Carpenter to produce the finest High Speed Steels for 60 years. And most important is the *personal attention* Carpenter men give to every order. The experience, pride and skill these craftsmen put into the production of every bar make Carpenter High Speed Steels your most dependable investment. Your best proof is to place your next order with Carpenter . . . and see what a difference there *can* be in High Speed Steels. THE CARPENTER STEEL COMPANY, 106 W. Bern St., Reading, Penna.



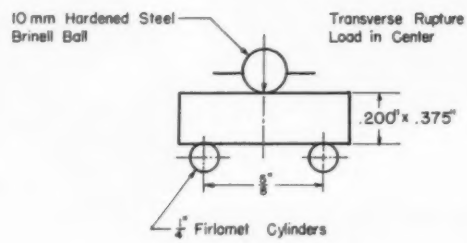
Every Order of *Carpenter* High Speed Steels Undergoes These and Many Other Quality Controls

- All scrap must be of purest quality, guaranteed analyses.
- Small, electric furnace melting units are used to control quality and uniformity to the highest degree.
- Every heat of steel is constantly checked for chemistry, temperature and melting time.
- Preheat and high heat furnaces are guarded for accurate time and temperature to prepare the steel for rolling.
- Percentage of reduction in cogging billets for rolling or forging of bars is skillfully controlled to assure freedom from internal stresses.
- Discs cut from each bar are acid etched, examined, hardened and fractured to certify internal cleanness, soundness, freedom from excessive segregation. And the hot acid etch is backed by Ultrasonic Testing.
- Slugs are cut from each lot of billets and machined in "step-down" fashion to guard against internal seams, shadow lines, etc.
- Extensive laboratory tests are made for proper hardness, micro-structure, grain size.
- Turning tests are run regularly to check cutting efficiency.
- *For best results, put your confidence in . . .*



Carpenter STEEL high speed steels

. . . Cemented Carbides from Page 94



$$S = \frac{3PL}{2WT^2}$$

S = Transverse rupture in pounds per square inch.
P = Breaking load in pounds.
L = Distance between supports.
W = Width of specimen in inches.
T = Thickness of specimen in inches.

Fig. 3. Schematic of the setup for measuring transverse rupture strength.

Specific gravity, measured in grams per cubic centimeter gives the degree to which the powder compact has been shrunk. The highest possible density is desired for each composition.

The transverse rupture strength is measured as illustrated in Figure 3. Resistance to breakage is considered to vary directly as the width, inversely as the span, and directly as the square of the thickness.

This test has been said to be a combination of sheer strength, compressive strength and tensile strength but it is, nevertheless, a useful guide for the day-to-day control and selection of compositions to withstand certain stresses placed on the carbide in its application.

We endeavor to obtain the highest possible strengths for our cemented carbides through the control of the particle size, shape and distribution of the various types of powder used.

Fig. 4. After low magnification inspection, fractured samples are mounted in plastic and given a metallographic polish for examinations up to 1500X.

Fig. 5. After a heat tinting process, a color examination, which more readily identifies constituents, is made with the Metallograph.

The fractured specimen is examined for fracture type and flaws discernible at 30x magnification. The fractured piece is then mounted in plastic and given a metallographic polish illustrated in Figure 4. This unetched, polished sample is examined at 200x magnification for porosity, free carbon infiltration and any type of contamination, Figure 5. It is then etched and examined at 1500x magnification for structure. This examination is made to determine the particle size, shape and distribution of the tungsten carbide and alloy phases and the cobalt distribution.

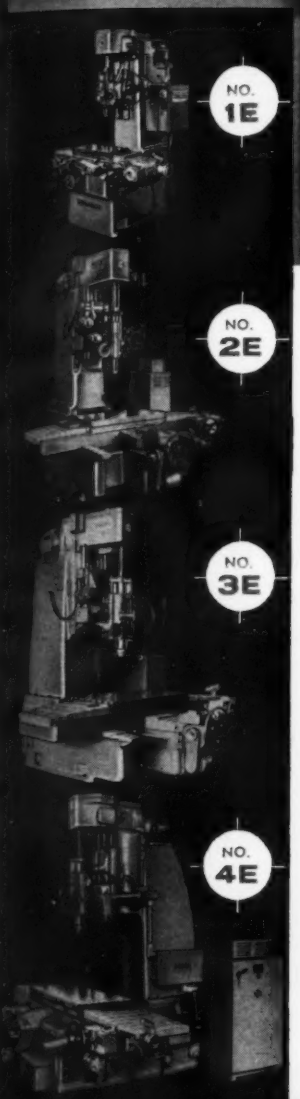
The samples that contain the complex carbides are also examined after a heat tinting process. Each phase of the heat tinted sample has a characteristic color when examined on the metallograph, whereas the same sample prepared by the normal method will show various shades of gray and white for the different phases. The advantage of the color examination is that each constituent is more readily identified.

Inspection of Finished Product

In the final inspection of material to be shipped, a representative number of pieces for each sintering heat are checked for hardness and density. The product is then sandblasted and inspected for size, straightness, chips, cracks and surface conditions.

We of Firlomet are convinced that uniformly successful carbides are produced only through rigid control of raw materials and all of the manufacturing processes. You may think that the controls we exercise over our product are costly. This is true, but the elimination of re-processing and the reduction of rejected finished products more than offset this cost. ΩΩ

Get to the POINT... *in a hurry!*



with

PRATT & WHITNEY *Electrolimit* JIG BORERS

The point we'd like to make is that Pratt & Whitney Electrolimit Jig Borers incorporate an exclusive method of locating the table that is *unbeatably* fast and convenient . . . and accurate to .0001".
Thanks to the P&W Precision Preloaded Ball Roll Quill, you'll be able to retain original accuracy and rigidity *indefinitely* without any adjustment or maintenance.
And there'll never be any loss of accuracy from wear.

NOW . . . Pratt & Whitney Electrolimit Jig Borers can also be furnished with positioning control by NUMERICAL DATA.

. . . COMPLETE LINE includes table sizes from 12"x24" to 36"x72".

Write for free copy of P&W Electrolimit Jig Borer Circular No. 587 . . .

ALSO FURNISHED . . . a full line of Pratt & Whitney End Measure Jig Borers which also deliver "tenths" accuracy year after year.

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How Do We Measure

MACHINE CAPABILITY?

by R. B. Nottingham
Manager
Quality Control Department
BRUSH ELECTRONICS COMPANY
Cleveland, Ohio

CAREFUL INVESTIGATION will often demonstrate that many of the frustrations which manufacturing personnel experience have their origin in a machine capability problem.

Let us suppose that a job is being run on a machine which is not really capable of meeting the required tolerance. Who gets frustrated?

1. The operator — because, try as he will, he still produces bad parts.
2. The supervisor — he has shortage, scrap and rework.
3. The inspector — he can't use modern methods but must inspect 100%.
4. The assembly department. Despite careful 100% inspection, a percentage of bad pieces is getting through, causing assembly difficulty and final assembly rejects.
5. The engineering department — the product doesn't work the way it was designed to.

. . . Continued on Page 112

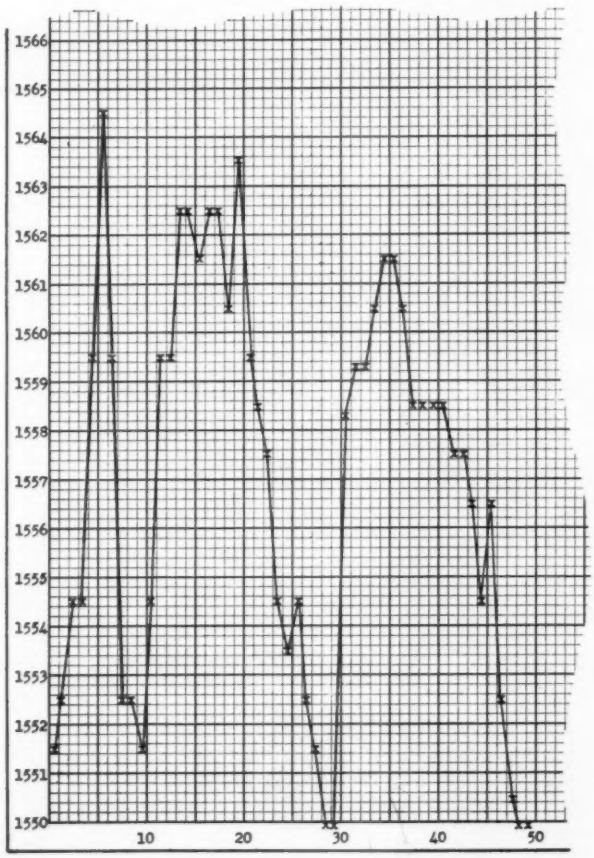
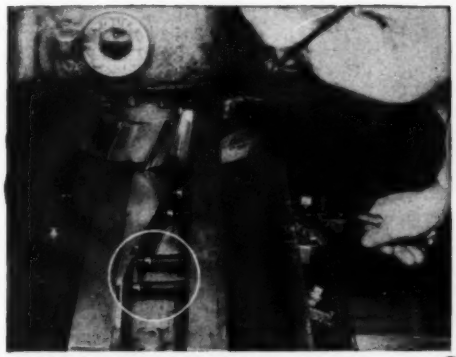


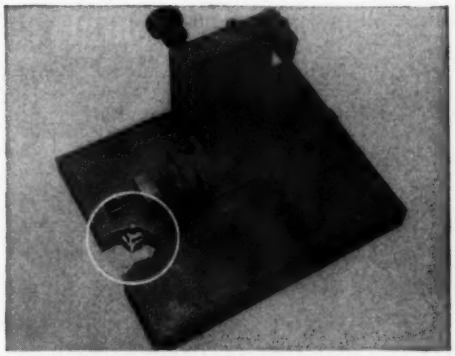
Fig. 1. Machine capability study; rotary mill #3. Here, dimensions in ten thousandths (vertical) are plotted against number of workpieces (horizontal). The rotary table carries 16 workpieces. The resultant graph shows the cyclical characteristic of the worktable per revolution.

What can be done to lower YOUR tooling costs?

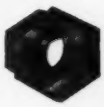
Thousands of companies are making drastic savings by using standard Vlier Tooling Specialties instead of costly custom-made substitutes. The applications shown below are only the *obvious* uses for these simple, inexpensive tooling specialties.

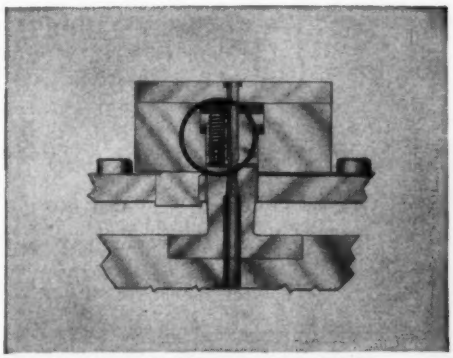


CLAMPING OFF-ANGLE PARTS in jigs and fixtures is a cinch with Vlier Swivel-Pad Clamps. Pad swivels on a ball, 7½° each side of center line. Can't bind or damage part surface. Socket set models can be inserted from either end.

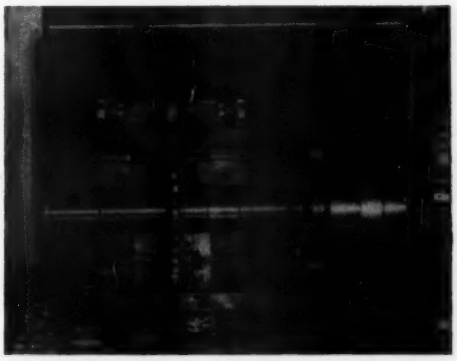


PERFECT ALIGNMENT OF JIGS AND FIXTURES ON MILL TABLES is assured every time with Vlier Fixture Keys. Each key is precision machined to three table slot dimensions, enabling the job to be run on any suitable mill in shop.





NEED ACCURATE, UNIFORM SPRING LOADS? Vlier Spring Plungers really pay off when positioning parts in jigs and fixtures. Spring loads are accurately set at the factory; stay constant. Plunger telescopes completely.



THE RIGHT AMOUNT OF CLAMPING PRESSURE AND NO MORE! There's no distortion of the part when Vlier Torque Thumb Screws are used to clamp it in the jig or fixture. Once predetermined end pressure is reached, the head turns freely. Working parts are protected from foreign matter.

Where can your tool room save?

Chances are, you can think of dozens of uses for standard Vlier Tooling Specialties—applications where expensive, complicated, home-made devices are now being used. *Why not write for your copy of the new 1956 Vlier catalog today?*

Originators of small parts that make a big difference in tooling costs!

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NEW ELECTRONIC INSTRUMENT GUARDS PRODUCTION LINE

A new portable electronic instrument for checking metals without laboratory analysis was recently developed. Called the "Metal Monitor," it can identify ferrous and nonferrous metals by comparative testing with known samples and can be used to sort mixed metals of unknown character into homogeneous groups for further testing. It can also be used to check stock, parts in process or finished products for many characteristics other than chemical composition, such as hardness, heat treatment, metallurgical structure, uniformity, plating thickness, and plating adhesion.

The Metal Monitor is manufactured by Brush Electronics Company, 3405 Perkins Ave., Cleveland, a division of Clevite Corporation.

Fig. 1. One of the uses of the Metal Monitor is to check castings for uniformity.

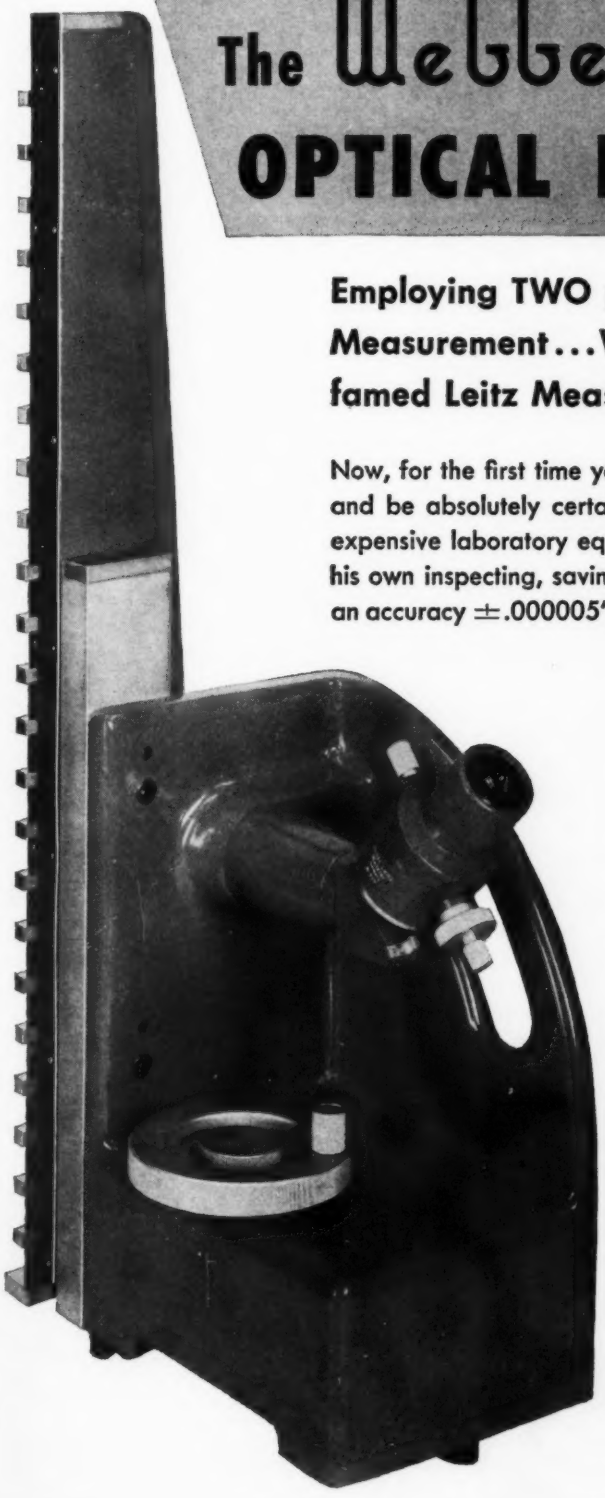
Operation of the device is based on a principle of the thermocouple effect — the junction of two dissimilar metals produces an electromotive force.

In operation, an electrode (with a self-heating element) is placed in

Fig. 2. The Metal Monitor being used to check parts for proper heat treatment.

A New Concept of Vertical Measurement

The Webber Micro-Accurate OPTICAL HEIGHT GAGE



Employing TWO proven Principles of Precision Measurement...Webber Gage Blocks and the famed Leitz Measuring Microscope

Now, for the first time you can make vertical measurements up to 49" and be absolutely certain of their accuracy. No longer is special or expensive laboratory equipment needed. The workman himself can do his own inspecting, saving expense, speeding production and attaining an accuracy ±.000005" per inch of length up to the full 49" of height.

A Working Tool

The new Webber Micro-Accurate Optical Height Gage is not a laboratory instrument, although it has laboratory accuracy. Any workman having ordinary skill, can use it right on the job to transfer measurements from a surface plate, with accuracies hitherto unknown. The time-consuming task of wringing gage blocks together is eliminated. The new Optical Height Gage is simple to use, will speed production, vastly improve accuracy . . . save money.

In 25", 37" and 49" models.

Next to your gage blocks, the new Webber Optical Height Gage will be the most useful tool in your shop.

Webber GAGE COMPANY

12903 Triskett Rd., Cleveland 11, Ohio

LARGEST EXCLUSIVE MANUFACTURER OF PRECISION GAGE BLOCKS

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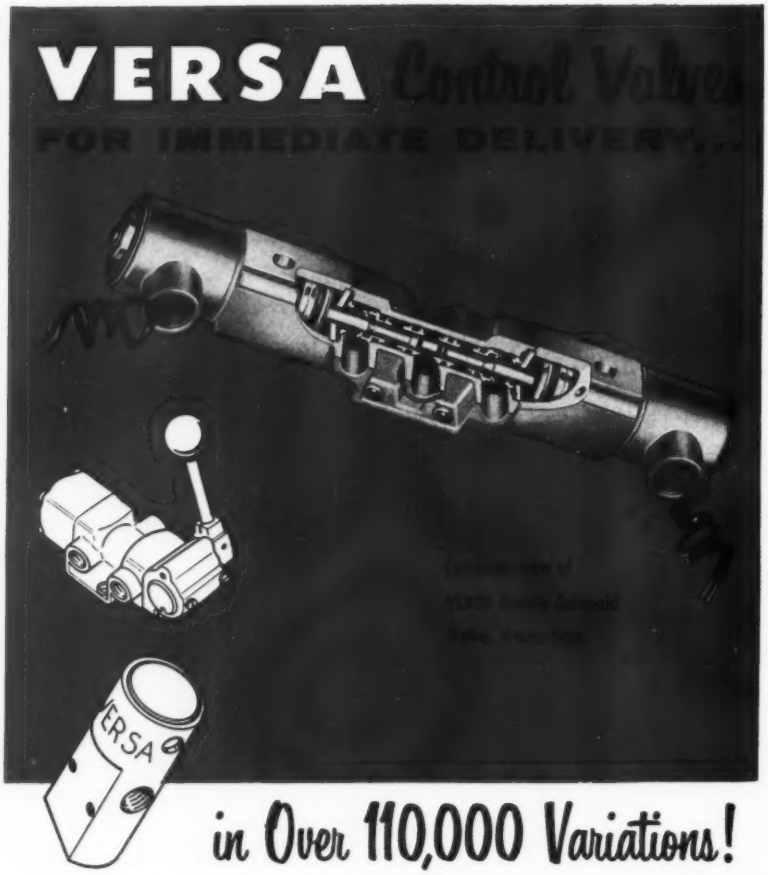
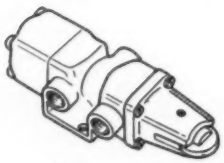


in Over 110,000 Variations!

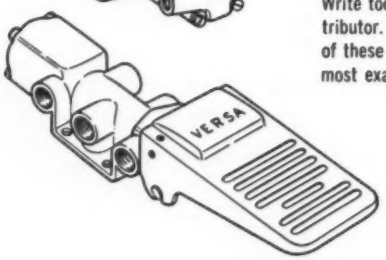


Versa Valves are available in 2-, 3-, 4-, and 5-way types with over 20 actuating devices, in sizes from ⅛" to 1" N.P.T., and for pressures from partial vacuum to 500 PSIG.

The entire line of Versa Valves (over 100,000 variations) are stocked by authorized Versa distributors, strategically located throughout the United States and Canada.

All Versa Valves are triple pressure and functionally tested under water for guaranteed leakproofness . . . actually exceed J.I.C. standards.

Write today for the name of your nearest Versa distributor. Remember, you can get immediate delivery of these rugged, compact control valves to fit your most exacting hydraulic or pneumatic requirement.



The entire line of VERSA Valves is explained in our new comprehensive Folder #14

VERSA

VERSA PRODUCTS COMPANY INC.
247-A SCHOLES STREET
BROOKLYN 6, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 110

contact with the metal to be tested. The voltage generated by this contact is amplified and transmitted to a meter on the Metal Monitor. The reading is then compared to readings obtained from samples whose compositions and metallurgical characteristics are known.

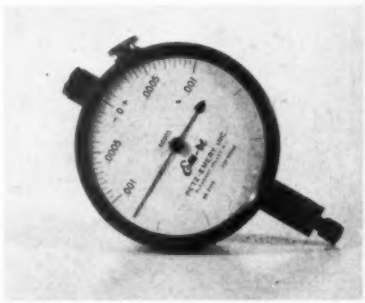
The device is easy to operate and requires no special or technical education on the part of the operator. It is portable (21 lbs) and can be moved to the job. This feature is particularly important since problems of metal comparison or segregation occur in many parts of the plant: storage racks and yard, heat treating and annealing, machine shop, production line, assembly, plating, final inspection, and other departments.

Since the Metal Monitor is nondestructive, it can be used on finished parts and assemblies and only a very small area of contact is required on the piece being tested. As many as 3,000 pcs/hr can be checked.

Extreme Accuracy Dial Indicator

A newly-designed dial indicator, "Em-Re" Model 21019, is graduated in 50 millionths (0.00005") over a measuring range of 0.002". With a bezel size of 2¼", the indicator can be read by an experienced operator to within ten millionths (0.00001").

The anti-magnetic indicator was developed to satisfy industry's increasing need for closer tolerances under production conditions. Every

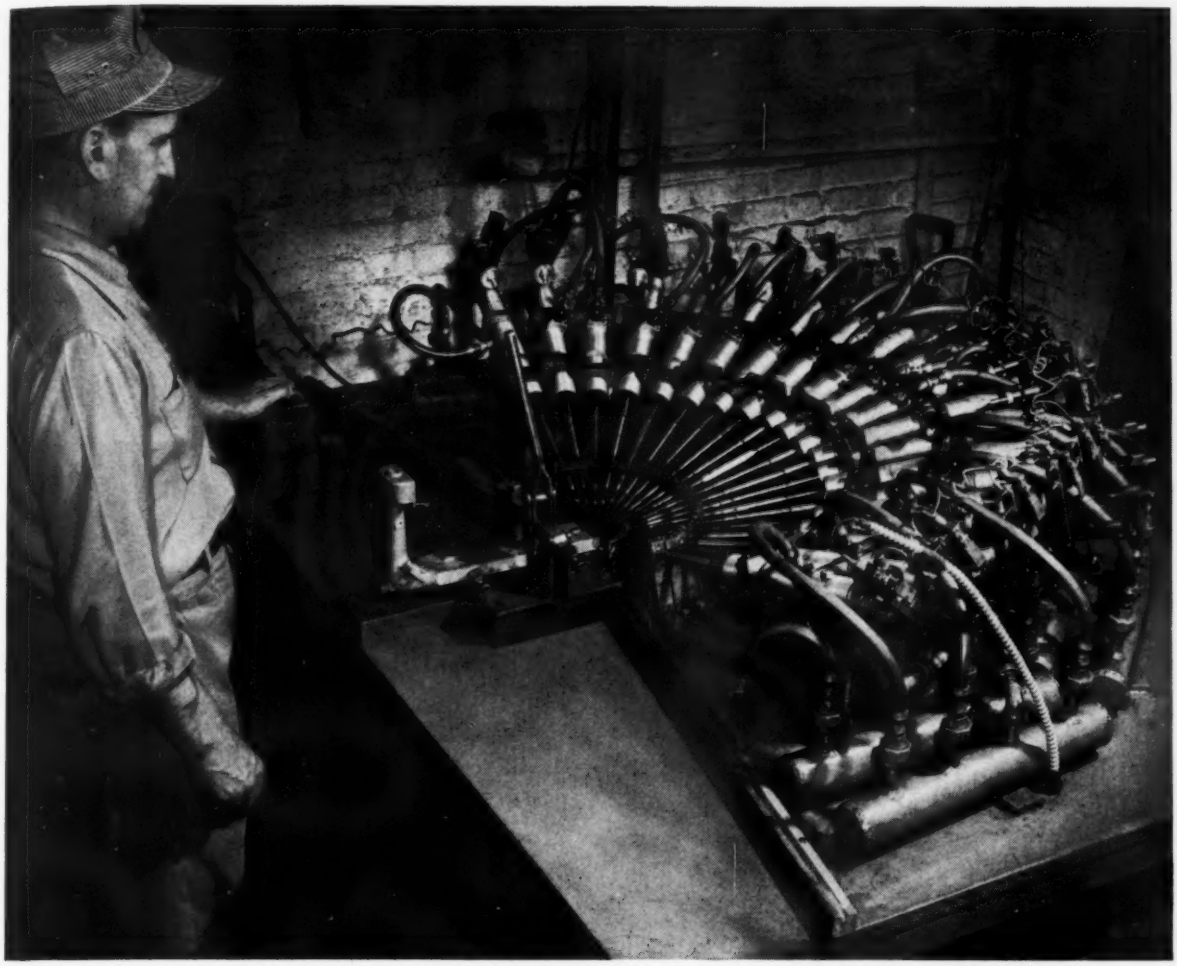


provision has been made for sensitive readings and repeat accuracy. The fully-jeweled movements are protected against shock or other adverse conditions.

This indicator is the latest addition to a line of 24 models offered by Petz-Emery Inc., Pleasant Valley, N. Y. For additional information, write direct to the company, or —

Circle Inform-A-Gram No. D1.

Gardner Denver . . . Serving the World's Basic Industries



Showing how the Airfeedrills are held in the fixture and how the burner casting is mounted in the jig. Manifolds, which assure proper air volume, are mounted on the bench around outside of tool fixture.

Press a button . . . 20 drilled holes! Use Keller Tool time-saver Airfeedrills

Hole drilling on this gas burner was a time-killer before Keller Tool Airfeedrills® took over. The job was formerly hand-indexed for each of the 20 holes. The drill press spindle was hand-fed for each hole.

Operator now presses the button on a 4-way air valve. Presto, 20 drilled holes in a 40-second cycle—automatically. The drills start simultaneously, advance, drill the holes, retract and shut off—automatically.

Keller engineering ingenuity + Keller air tools = production cost reductions. How about investigating?

GARDNER - DENVER

KELLER TOOL division, Grand Haven, Michigan

THE QUALITY LEADER IN COMPRESSORS, PUMPS, ROCK DRILLS AND AIR TOOLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

CIRCLE INFORM-A-GRAM KEY NO. 111

. . . Machine Capability, from Page 106

6. The sales department — poor performance and customer complaint.

All this for lack of machine capability. In all probability the job was not deliberately run on an incapable machine, but the capability of the machine for that operation was just not known.

What do we mean by machine capability? A specific operation is being performed on a given machine with certain stock tooling and setup. We are concerned with one dimension. We find that all of the parts show different values for this dimension, if we measure fine enough. These measurements follow the normal curve, and by basic statistical methods we can calculate the spread or 3-sigma limits.

While substantially no parts will fall outside these limits, they still do not allow room for setup error and for tool wear. We, therefore, will ask for 4-sigma limits which means that we are allowing plus or minus 1/6 of the process spread for setup and wear.

Now, if these limits are within the blueprint tolerance, we are in good shape. With reasonable care, we can run this job with only a rare freak defective. But, if the blueprint tolerances are any less than our 4-sigma value, we are in trouble; the same frustrating trouble described earlier.

Let's suppose that we are deliberately running a job with 5% defective when centered on nominal. A shift of only 1/6 of the spread will jump our percent defective to 17.1%. This will often be the difference between profit and loss.

Fig. 2. The special 4-spindle machine developed for milling the thickness dimension of small blocks of water soluble piezoelectric crystals. The case history covered in the text concerns the ability of the setup to hold the crystal thickness to 0.1560". The four spindles are diametrically opposed pairs.

All right, how do we measure machine capability? First, we select a number of pieces in order, measure them and record their measurements. How many pieces? This depends on several factors, number of stations on machine, rate of production, cost of inspection, and any prior knowledge. In general, from 20 to 150 pieces are required with 50 being typical.

Step one, graph the measurements in sequence. Since normal variation may obscure the trends or cycles we are looking for, the graph may be smoothed by using a moving average. A moving average of three is often used.

This means that the first point we plot, Figure 1, is the average of the last reading, the

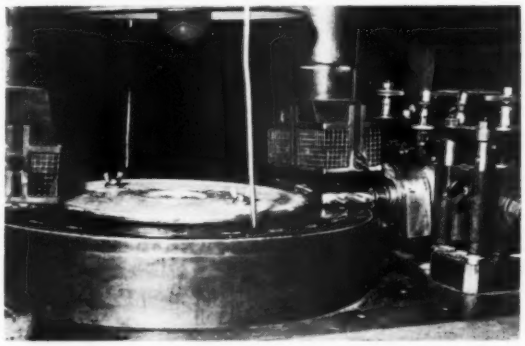


Fig. 3. Close-up showing two of the machine's four Tangtun cutter-equipped high speed spindles. The rotary table has a vacuum chuck which carries 16 crystals. Crystal surface finish is held to less than 50 microinches.

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first reading, and the second reading. The second point is the average of the first, second and third readings. The third point, the average of the second, third and fourth readings, etc. If we were to plot the points individually, each point would represent a true point on the variation cycle but modified by random variations such as vibration which do not properly belong in our cycle.

Errors of measurement would also enter in. Since these errors are random, the use of averages of three points tends to cause them to cancel each other out giving the true picture of the cycle of interest.

This will show rate of wear and cyclical tendencies. Figure 1 clearly shows a cycle being equal to one table rotation since in this operation the feed table does have 16 stations — one workpiece per station.

The machine in question is a rotary 4-spindle milling machine, Figure 2, with four milling

. . . Continued on Page 230

JOHANSSON GAGING EQUIPMENT

Assures You Precision to the Finest Degree to Meet Your Requirements —Backed by the Name Supreme in the World of Measurement.

GAGE BLOCKS

(JOHANSSON) and accessories.
Short deliveries. Inspection and reconditioning service available at our plant.

INTERNAL INDICATORS

(for inside measurements .155 to 24 inches) Scale range plus or minus .001 graduated to .0001 and minus .020 graduated to .0001.

MIKROKATOR

(Amplifier—for outside measurements) Graduations .0001 to .000002 or .001 M to .0002 M.

OTHER JOHANSSON PRODUCTS

Micrometers, Snap Gages, Extensometers, Dynamometers, Hardness Testers, Surface Finish Indicators, Interferometers, Plugs, Rings and Special Gages.

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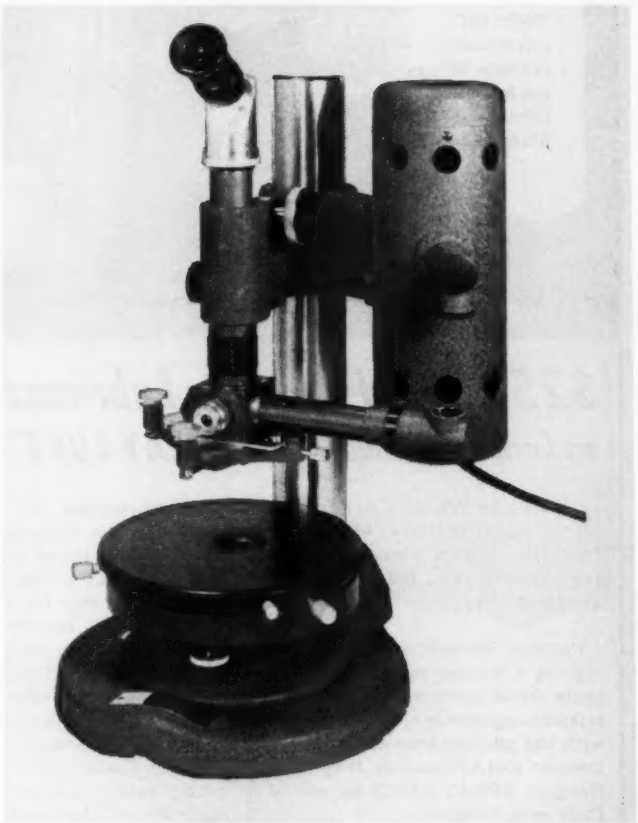

MULTIMI

Multiple Interference Microscope

The Multimi is an instrument for both scientific and practical measurements through which the possibility has been given to everyone to make use of the great advantages of the interference methods. Interferometric methods have been used for a long time to study and measure deviations in the height of surfaces, thickness of thin layers, etc. The accuracy of the Multimi is as high as .04 micro inches, which means an accuracy of about the same value as the atomic dimensions. The fringes are here replaced by what can be classified as lines which constitute real profile curves and contours, exactly reproducing surface shapes of different kinds. The instrument is adapted for photographing the interferogram by a miniature camera. Low reflecting, normal reflecting and high reflecting interference plates are available. It is highly recommended for the following: Surface finish measurements . . . surface finish on quartz plates . . . thickness of films and coatings . . . thermal and mechanical deformations . . . cell research, etc.

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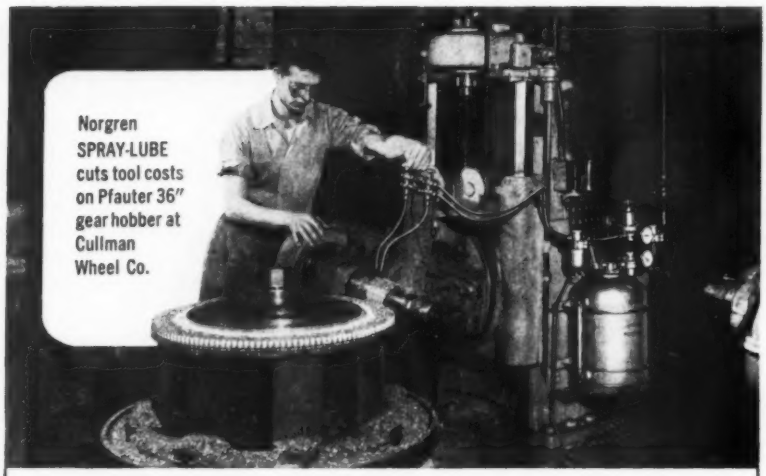
10641 HAGGERTY AVE. • BOX 4086 NORTHEASTERN STATION • DEARBORN 1, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 113



$250 Saved Yearly in Lubricant Alone on Each Gear Hobber with SPRAY-LUBE*

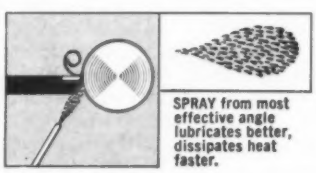
...Cullman Wheel Co. also reports substantially increased tool life, safer, cleaner working conditions, less machine cleanup time.

Cullman Wheel Company in Chicago is a leading manufacturer of chain drives and other power transmission equipment. Dissatisfied with the performance of flood systems of tool lubrication, they tried Norgren SPRAY-LUBE on one of their gear hobbers.

Results of the trial were so favorable that they at once began converting the coolant systems on other gear hobbers and shapers to Norgren SPRAY-LUBE.

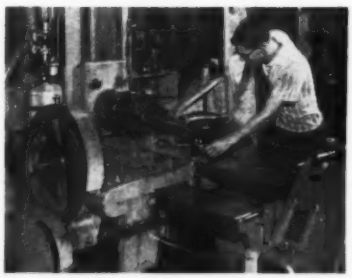
Today, from the many SPRAY-LUBE applications in their plant, they have reported the following facts:

Norgren SPRAY-LUBE applies a spray of cutting oil upon the close interfaces at the cutting area, providing a more thorough lubrication at the cutting point between the tool and work piece. As a result, tool life has substantially increased.


SPRAY from most effective angle lubricates better, dissipates heat faster.

SPRAY-LUBE sprays lubricant exactly where it is needed with no waste. It does a much more thorough lubricating job, using considerably less lubricant. In fact, savings in lubricant cost alone are averaging $250 a year per machine —enough to pay for the Norgren SPRAY-LUBE System in about 6 months.

In addition, SPRAY-LUBE has provided other valuable advantages —improving product finish . . . simplifying chip removal . . . reducing machine cleaning time . . . and providing safer, cleaner floor conditions around the machines.


Norgren SPRAY-LUBE saves nearly $250 a year in coolant cost on Gould & Eberhardt gear shaper.

Without obligation, learn how Norgren SPRAY-LUBE can reduce costs in your plant. Call your nearby Norgren Representative listed in your telephone directory — or **WRITE THE FACTORY FOR BULLETIN 537.**

C. A. Norgren Co.
3449 So. Elati St., Englewood, Colorado

Pioneer and Leader in Oil-Fog Lubrication Since 1930

For complete information about this application, write for Norgren Blueprint SL-7.

THE AUTOMATIC FACTORY — A Critical Examination by S. A. June, J. D. Bardis, L. H. Lurio, L. S. Polaner, O. Sagedahl, H. A. Sklenar, and B. K. Yenkin. Published by Instruments Publishing Co., Pittsburgh 12, Pa., 1955. 88 pages, $1.50.

This concise report of the many facets of automation and "manless factories" was prepared as part of the requirements of the manufacturing course of Georges F. Doriot at Harvard's Graduate School of Business Administration. The student-authors researched, travelled, and interviewed the leading automation authorities in gathering the facts and preparing their objectively-presented report.

As a result of their study, the seven young men assembled an unbiased view of the automatic factory and its consequences. Particular chapters clarify Mechanization vs. the Automatic Factory; Contemporary Automaticity (in automobile and four other plants); Costs; Social Implications; and Cost Determination of "Project Tinkertoy," the ceramic-wafer, printed-circuit development undertaken by the National Bureau of Standards.

Detailed cost-comparisons of conventional vs. Tinkertoy hand and Tinkertoy machine techniques are included in an appendix to show all the factors that enter into a cost determination analysis for deciding the value of automatic production. Ten other case histories, in short form, further illustrate the place of automation in industry.

TOOL DESIGN by William R. Jeffries. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N. Y., 1955. 217 pages, $5.25.

Actual instructions on how to design machine tool jigs and fixtures, weld and assembly fixtures, punch press tooling, and hydraulic press tooling are included in this introduction to the field of tool design.

Helpful reference appendices provide factual data on such topics as drafting practice, standard drill bushings, standard die sets, and standard parts.

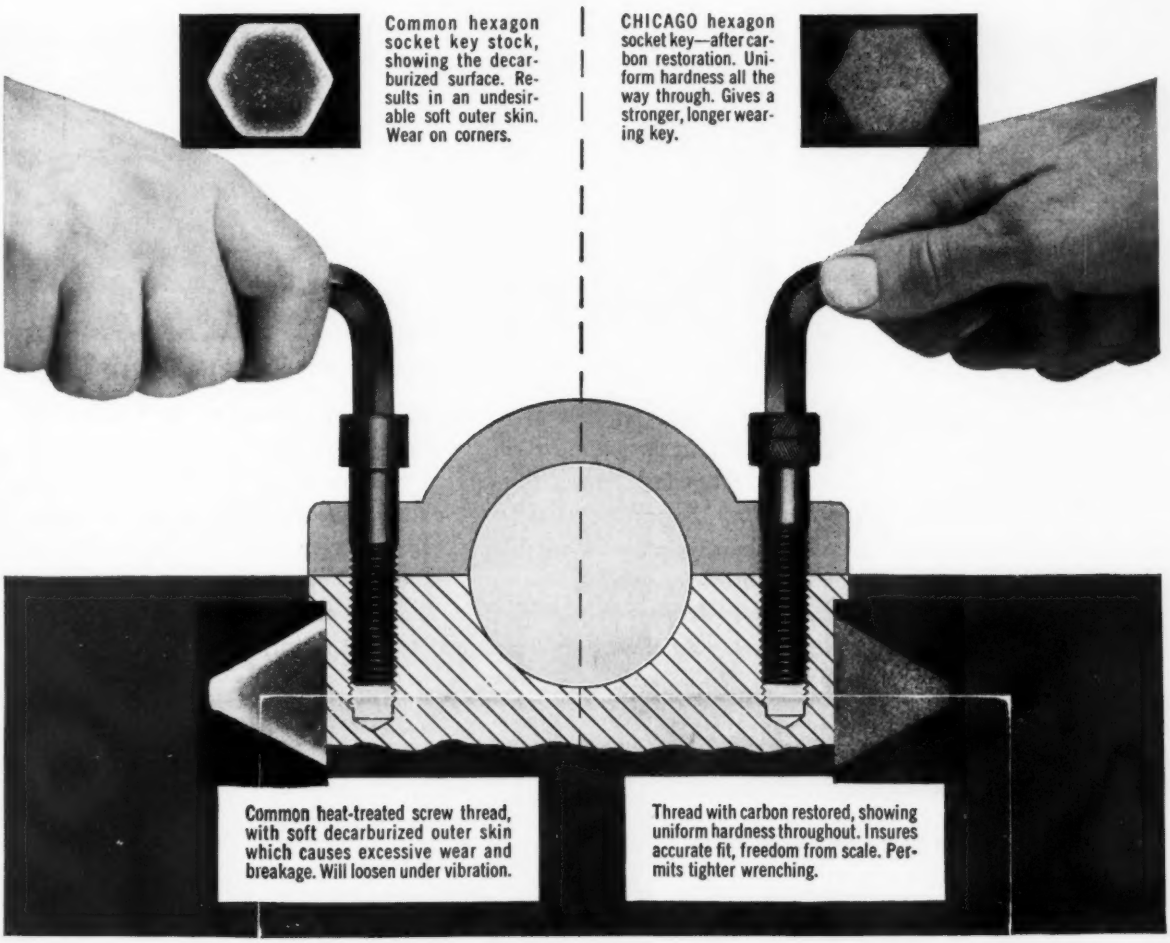
It is written especially for readers who have no previous knowledge of tool design, but who are familiar with the more common machine tools and manufacturing processes. The book should lend itself as a text for technical classes.

. . . Continued on Next Page

CIRCLE INFORM-A-GRAM KEY NO. 114

How carbon affects fastener performance

Screw fasteners may look identical, but the microscope reveals a wide difference in their ability to "take it"


Common hexagon socket key stock, showing the decarburized surface. Results in an undesirable soft outer skin. Wear on corners.
CHICAGO hexagon socket key—after carbon restoration. Uniform hardness all the way through. Gives a stronger, longer wearing key.
Common heat-treated screw thread, with soft decarburized outer skin which causes excessive wear and breakage. Will loosen under vibration.
Thread with carbon restored, showing uniform hardness throughout. Insures accurate fit, freedom from scale. Permits tighter wrenching.

THE CHICAGO SCREW COMPANY

DIVISION OF STANDARD SCREW COMPANY • ESTABLISHED 1872

2519 WASHINGTON BOULEVARD, BELLWOOD, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 115

Zagar Gearless Drill Heads

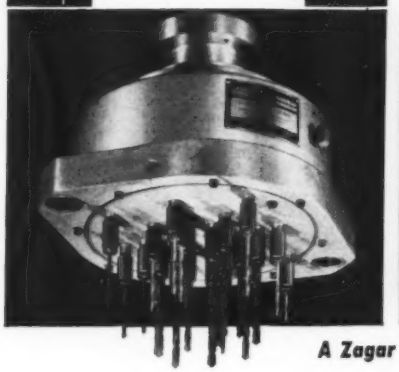
put 4 big advantages to work for you

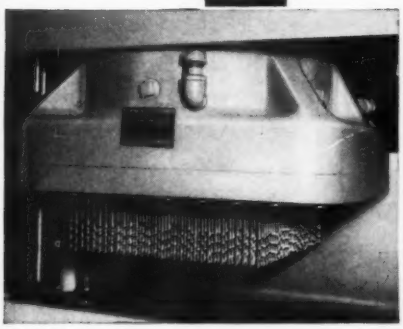
Any number of holes

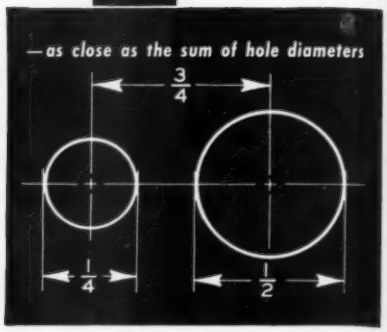
Any hole pattern

Any material

On all centers







A Zagar drill head is never obsolete. Zagar can re-locate spindles for other hole patterns.

Can you visualize the savings made possible by drilling up to 1000 holes at one pass? Zagar standard practice can handle any machinable material up to 1½" diameter. Holes of varying diameters can be drilled to form any pattern. Zagar Gearless Drill Heads, their efficiency proven by many years' success, can be installed on existing drill presses. Or, Zagar will lay out the necessary tooling for your entire job. May we see your sample parts and study your requirements? There is only one *right* answer—one *best* answer—for those requirements. May we supply it?

Let **ZAGAR** tooling plan the complete job for you

Whether your runs are long or short, let Zagar engineering survey your needs with a view to saving you the cost of special machines. In the case at the right two lines of *standardized* self-clamping drill jigs ream, tap and drill an aluminum die casting, both valve body and cover. The problem of limited production was readily solved. What, sir, are your requirements?

ZAGAR, INC. 23894 LAKELAND BOULEVARD, CLEVELAND 23, OHIO

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

Write for Technical Data Sheets "T-5" for more information.

CIRCLE INFORM-A-GRAM KEY NO. 116

. . . Book Reviews, from Page 114

HOW TO NEGOTIATE A SUCCESSFUL CONTRACT by Louis M. Brown. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N. Y., 1955. 290 pages, $5.65.

This book avoids a discussion of the preparation of contracts, yet it should be valuable to businessmen in helping them create better contracts. It shows how to avoid incomplete or invalid agreements, how to make certain an agreement's terms and provisions fill the businessman's needs and desires, how to get maximum legal protection, and how to minimize the possibility of something "going wrong."

Each chapter covers a fairly typical contract negotiation, as prepared from the author's 22 years of experience in law. The chapters follow a standard outline of discussion, form, and points to remember, and clauses peculiar to various contracts receive special attention.

The chapter titles and topics include: The Ingredients of a Contract, Stockholders Agreements, Partnerships, Employment Agreements, Sales Agency Agreements, Sales of Business Assets, Deeds, Leases, Building Construction, Negotiable Promissory Notes, Guaranties, and Chattel Mortgages and Pledges.

ELECTRONIC DATA PROCESSING FOR BUSINESS AND INDUSTRY by Richard G. Canning. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, 1956. 332 pages, $7.

What is electronic data processing? What can it do for a company? How should the company go about investigating it? These are some of the questions answered in this book. It discusses the application of digital data processing devices to business clerical functions and categorizes this electronic data processing as regular capital equipment which can be evaluated practically and realistically for an effective course of action.

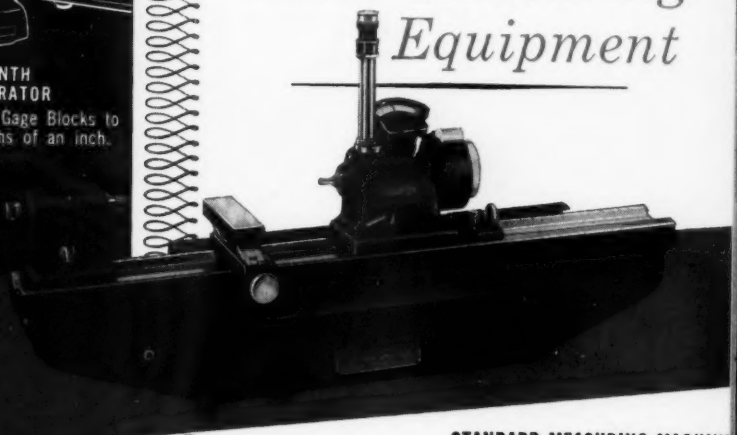
The book's language is that of management, but the author writes without stinting on the technical accuracy of engineering points. He emphasizes the results of electronic data processing, and provides only those details of the equipment that are necessary to apply the machines to business problems.

The volume covers briefly the basic operations of electronic computers and describes the method of instructing the machine to perform varied clerical operations. Applications such as production control in a manufacturing plant are analyzed in some detail and electronic control systems to meet specific requirements are outlined.

PRECISION GAGE BLOCKS
Basic master standards of measurement, accurate to millionths.

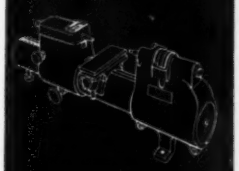
MILLIONTH COMPARATOR
Checks Gage Blocks to millionths of an inch.

To *Insure Quality*
INSURE PRECISION
Use
PRATT & WHITNEY
Basic Measuring Equipment



STANDARD MEASURING MACHINE

ELECTROLIMIT UNIVERSAL INTERNAL COMPARATOR
Reads direct to .00002"



SUPERMICROMETER
Reads direct to .0001"

You'll have the best Quality-Insurance obtainable if you make it a policy to determine the *correct* degree of precision for *your* products and then maintain these limits . . . broad or close . . . dependably and accurately, year after year. And the *best* way to provide your plant with this *Basic Accuracy Protection* is by using Pratt & Whitney Basic Measuring Equipment as a constant check on the accuracy of your *working* gages.

The heart of Pratt & Whitney Quality Protection is the Standard Measuring Machine shown here. Reading direct to .00001", it's a basic unit for any Standards Room. Used with the other equipment shown, you'll underwrite Quality, insure Precision and receive lasting dividends.

Write, outlining your Quality Control requirements, for complete recommendations on Pratt & Whitney Basic Measuring Equipment to meet your needs.

PRATT & WHITNEY COMPANY
INCORPORATED
15 Charter Oak Boulevard, West Hartford 1, Connecticut
Direct Factory Representatives in Principal Cities
MACHINE TOOLS • GAGES • CUTTING TOOLS

QUALITY CONTROL OF JOB-LOT PRODUCTION

by Joseph Kalmanek
Chief Inspector

SCULLY-JONES AND COMPANY
Chicago, Illinois

MUCH HAS BEEN WRITTEN and certainly additional information will continue to follow on the various applications and degrees of Quality Control. We at Scully-Jones and Company know that, despite the fact that each of the many skilled operators which we employ wants to produce a quality product, adequate means must be provided for them to achieve that end. Obviously, equipment, tooling, gaging and methods as well as inspection are all important factors as prime requirements for the ultimate production of a quality product.

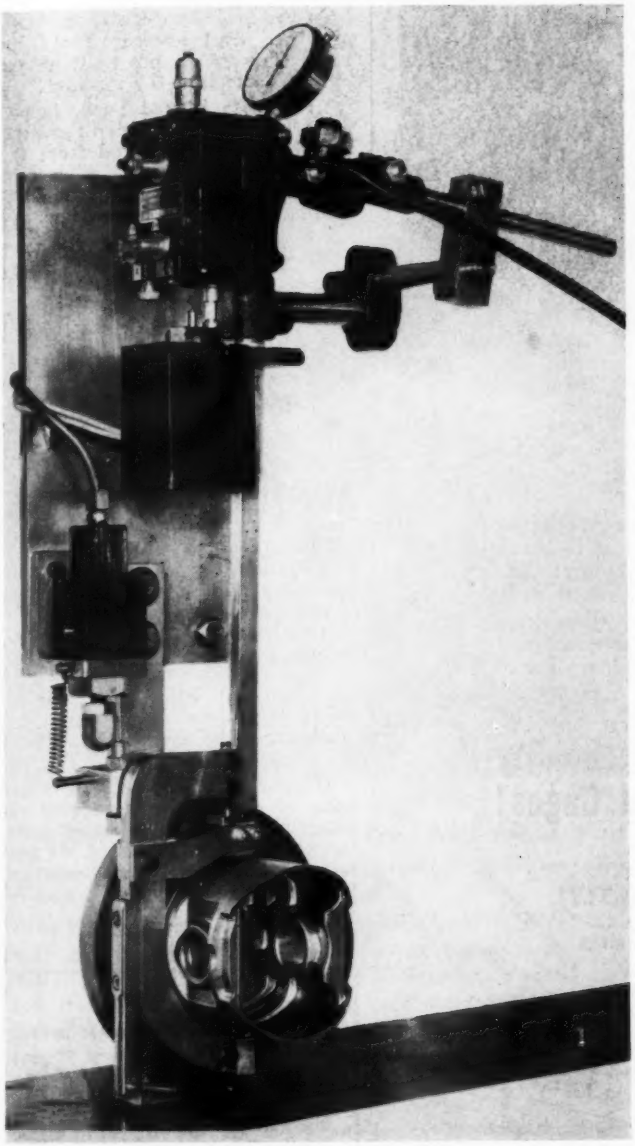
In our search for a yardstick of quality control, we had to bear in mind the fact that over 50% of our annual production may well be termed short-run jobs, not exceeding 75 items per order. We reviewed the advantages and disadvantages of a statistical quality control program as applied to our methods and processes. Our thinking had been that a statistical quality control program could only be applied to highly repetitive operations such as centerless grinding.

Our primary machining departments, turret

. . . *Continued on Page 232*

Fig. 1. This "P. Q. Scope," a combination control chart and calculator is, in itself, a time-saver and aid to accurate records.

FOSTER ELECTROSIZER PISTON GRINDING GAGE



PATENTED 2464387

Why not contact us for assistance on your grinding problems?

Ever since the beginning of mass production of automobile motors, one of the most costly and time consuming problems has been the matching of pistons to the cylinder bore. At one time certain manufacturers used as many as eighteen or more piston classifications for a single type of engine bore. Today, most builders use five.

As automotive plants are being automated it has become necessary to accurately measure the pistons during the grinding operation in order to assure the correct number of each classification for final assembly to the various bore sizes in blocks.

One of the most promising "in process" grinding gages developed to date is the "FOSTER ELECTROSIZER PISTON GRINDING GAGE". Extreme accuracy is guaranteed.

This unit is designed primarily for automated piston lines but may be readily adapted to semi-automatic production as well.

Provision has been made in the gage to check piston size at the point of major diameter only. Two signals are given by the "FOSTER ELECTROSIZER GAGE HEAD". The first is to shift the machine into final slow finishing feed, the second to retract the wheelslide when size is reached.

During the loading and ejecting period, the gage points are held open by means of a small hydraulic cylinder. Re: cycling of the gage is accomplished by means of a solenoid synchronized with the machine cycle.

This gage is typical of all Foster units designed to keep maintenance costs at a minimum. Adjustment for size is obtained by merely rotating a micrometer screw graduated in .0001" for greater or less stock removal.

FOSTER ENGINEERING CORPORATION
4200 NORTH WOODWARD AVE. • ROYAL OAK, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 119

BESLY

Precision Tooling and Gaging Application Service

- *SAVES YOU ENGINEERING HOURS*
- *GIVES YOU HIGH PRODUCTION*
- *REDUCES YOUR COSTS*

Determining the style and type of cutting tools and gages that will do a given job best often takes engineering hours that you can ill afford to spare these days.

You can save many of these hours with Besly's Application Service. Besly Service Engineers are completely up-to-date on cutting tool and gage selection and application. They can analyze your jobs, select the right tool, and help lay out tooling set-ups to achieve longer tool life, less downtime, fewer rejects, and increased production. This service includes the development of "special" tools to fit your special needs. If you'd like proof of how it can work for you, write us.

You Get Assured Cost-Cutting Quality with Besly Cutting Tools and Gages!

COMPLETE LINES

PRECISION ACCURACY AND QUALITY

STANDARDS AVAILABLE FROM STOCKS

FAST DELIVERY ON "SPECIALS"

Engineering, Service, and "Specials" are a BESLY SPECIALTY!

BESLY

BESLY-WELLES CORPORATION

Est. as C. H. Besly & Co., 1875

128 Dearborn Avenue • South Beloit, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 120

LAPPING MACHINE EASILY UNLOADED BY HINGED PORTS

To assure easy, fast and safe removal of precision lapped piece parts from the new Gyro-Matic "21" lapping machine, the Spitfire Tool Company, Chicago 41, has built unique hinged ports into the machine.

With these hinged ports, lapped parts within their position nests can now be readily removed from the lapping plate along with their nest. This means quantity loading and unloading that saves costly time.

The theory behind Spitfire's hinged ports is based on reports from the field. This survey determined it is far easier to slide off precision lapped parts from a lapping plate rather than pick them off individually. In addition, this parts-within-nest removal provides maximum safety for lapped parts, practically eliminating the possibility of nicking or other damage.

The ports are actually hinged sections of the Gyro-Matic's gear retainer plate. To unload lapped parts, the port is swung open and the gear retainer rings, the Micarta positioning nest, and lapped parts are all removed with ease.

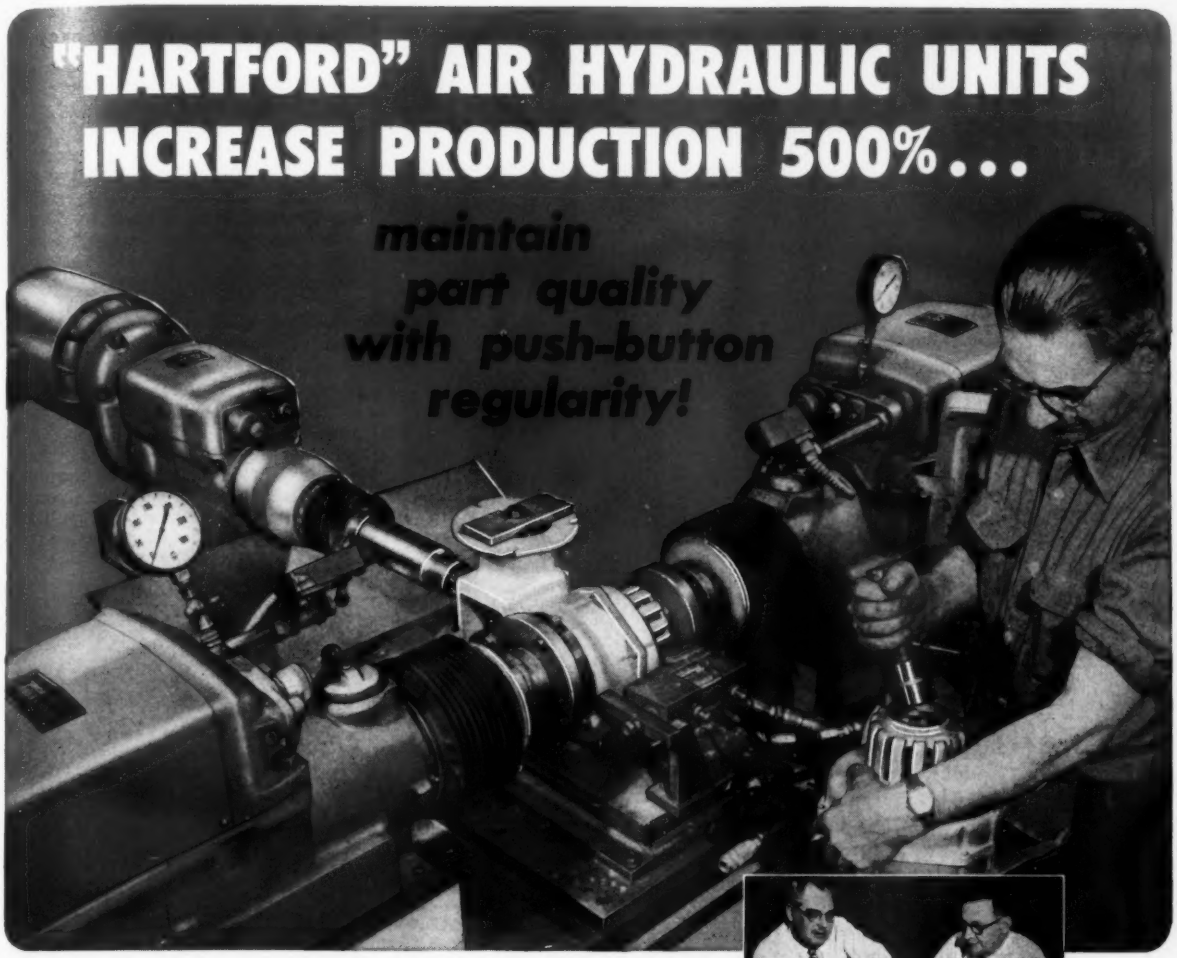
In order to insure high quality of its products and to develop new production techniques, American Controls Division of Robertshaw-Fulton Controls Co. has established a unified engineering department at its St. Louis plant. The department brings under single direction all testing and quality control functions at the division. Robertshaw-Fulton is a major producer of control devices and components for industrial applications.

◆

Your Inform-A-Gram Card may be found on page 136.1. It is for your convenience in making inquiries.

"HARTFORD" AIR HYDRAULIC UNITS INCREASE PRODUCTION 500%...

maintain part quality with push-button regularity!



Report from the Nu-Way Corp., Rock Island, Illinois, leading manufacturer of high pressure gun-type oil burners.

Three Hartford units in a special production machine solve a critical bore alignment problem for Nu-Way. Two opposed units rough and finish bore and finish face bosses in sand cast aluminum blower housings. Through an electrically controlled sequence, rate of feed and speed is automatically regulated for roughing and finishing operations. Simultaneously a third unit at the rear is tapping a 1½" hole 90° from the two in-line bores. By roughing and finishing in one setting, perfect alignment between motor and pump bores and facings in relation to the pedestal of the burner is maintained. By changing the holding fixture, three different models of burner can be machined. On Nu-Way's model XL-2000 alone production has jumped from 14 to 80 pieces per hour!

ROBERT TURNER, Prod. Mgr., (left inset) says, "In addition to keeping rejects to a minimum, inspection is simpler and a rigid standard of quality control has been maintained."

ELMER DOYLE, V.P. in charge of production, (right inset) says, "Hartford Drill Units are doing everything we can demand in an auto-cycle operation."

GLEN LASCHANSKY, operator of the machine says, "After I set up the first casting, I never have to worry about the three drill units or the machine's operation. It will run at close tolerance as long as I press the button."

Benefit from Nu-Way's experience. Let Hartford Drill Units give you better products at lower cost through better methods.

HARTFORD Special

MACHINE TOOL DIVISION K-507-5
THE HARTFORD SPECIAL MACHINERY CO.
252 Homestead Avenue, Hartford 12, Conn.

☐ Have Field Engineer call.
☐ Send Application Data Sheet and descriptive Bulletin.

Name _____
Company _____
Street _____
City _____ Zone ____ State _____

CIRCLE INFORM-A-GRAM KEY NO. 121

NELCO CARBIDE TIPPED MILLING CUTTERS . . . CUT YOUR OVERHEAD!

You DON'T grind steel with a diamond wheel — when you use NELCO Cutters!

All carbide cutting surfaces overhang steel body!

NELCO sandwich braze guarantees a rugged, one piece cutter that works to close tolerances, can't chatter, teeth don't work loose!

NELCO pioneered slash milled design —gives more chip clearance—means less grinding— gives greater production between grinds!

Gang cutting made simple— slot, maintain width with multiple cutters and shims!

Those who buy tools for lasting performance as well as initial appearance always specify "Nelco". These carbide tipped Milling Cutters are precision built for rugged dependability, engineered to "take it"—singly or in gangs —to save *real money*, deliver fast and accurate results without the operational and maintenance "headaches" of most conventional cutters. Look for benefits *and* appearance— call for Nelco—your distributor has the size and type you need in stock.

SEND TODAY for complete catalog showing over 700 Nelco carbide tipped tools engineered to make dollars and sense.

NELCO TOOLS

For that EXTRA Edge in Production!

NELCO TOOL CO., Inc. • Manchester, Conn.

FROM INQUIRY TO SALES

A new and effective system for the positive control of industrial advertising inquiry response and prospect follow-up has been devised by Advertising Controls, Incorporated, Cincinnati, Ohio. The copyrighted system, named "Exact", can be handled entirely on the clerical level but conveys to the prospect the impression of executive attention through instant and expert handling of advertising inquiries.

Installation of the system results in the accumulation of data relative to advertising effectiveness, cost of advertising per dollar of sales directly traceable, dealer and salesman performance, percentage of inquiries converted to sales, relative strength of various advertisements, publications, and direct mail pieces.

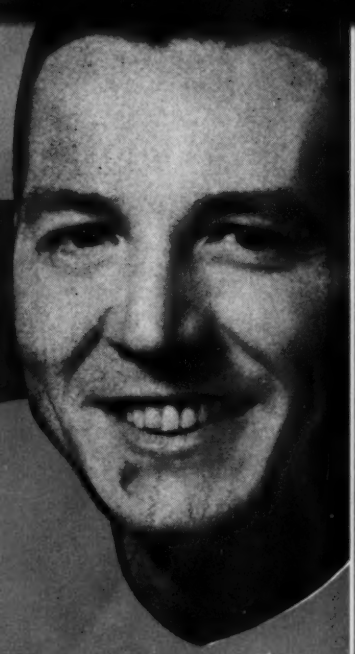
The "Exact" system of advertising control includes 5,000 six-part inquiry record and follow-up forms, one four-drawer 5" x 8" card file cabinet together with all guides, indexes, signals, etc., one pad of monthly analysis sheets, and two copies of the "Exact" manual of operation.

The system includes an ingenious six-part one-time carbon form which provides checking spaces for every scrap of information which an inquiry normally carries and for setting the information up for subsequent referral and orderly follow-up. The system is set in motion by a primary classification of the inquiry by the sales manager. Then a prescribed sequence is followed which includes same-day inquiry response, referral to the proper salesman or dealer, follow-up letters to prospect, and reminders to salesmen at predetermined intervals.

A bulletin covering the system is offered by Advertising Controls, Incorporated, 2330 Victory Parkway, Space 303, Cincinnati 6, Ohio.

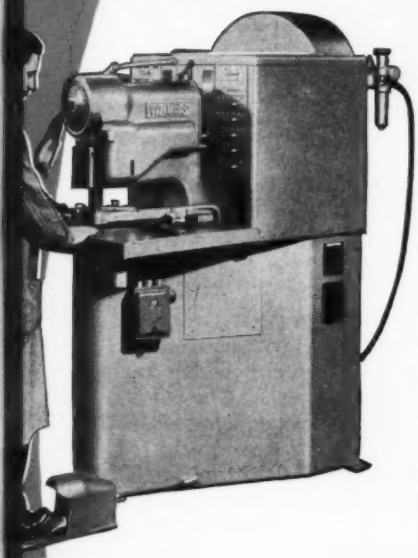
Circle Inform-A-Gram No. D2.

"WALES-WAY" showed us how to SPEED-UP hole punching OVER 50% ...



with the

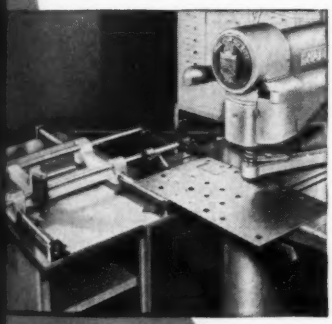
WALES FABRICATOR



Here's a big money maker in any sheet metal shop. Punches and dies for round and shaped holes take only seconds to remove and replace. Complete sets are always ready in handy cabinet. For holes up to 3½" diameter the "WALES-WAY" quick change method saves plenty of time on your job. The WALES FABRICATOR is the PRACTICAL single-hole punching equipment with plenty of reserve power for punching up to ¼" plate.

Immediate deliveries, and you may pay for this equipment out of profits if you wish. Let us tell you about this plan.

The NEW positive DUPLICATOR



This husky WALES DUPLICATOR increases the scope of your WALES FABRICATOR to make production runs both practical and profitable. It permits positive duplication of unlimited hole patterns from master templets to jig borer tolerances. The templet is secured in steel work table T slots of DUPLICATOR. Cam action clamps position work piece. Holes are located quickly and easily by a stylus type locater pin. Press gently and the hole is duplicated EXACTLY on the work piece. The WALES positive DUPLICATOR does a terrific job. Any man in your shop can handle it perfectly in a few minutes.

Send For Bulletin No. IID

Get the complete story of the WALES Sheet Metal FABRICATOR with proof of performance. The facts about the positive DUPLICATOR are included. This is the type of equipment that merits your consideration NOW.

See the NEW WALES MOBILE FIELD UNIT

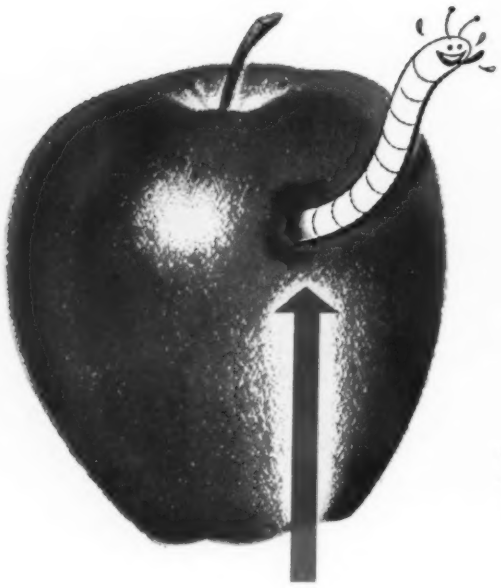
Outfitted with Fabricator, Duplicator, Tooling and equipment to show you, right at your door, the money making potential of the "WALES-WAY". Let us arrange for the Field Unit to visit YOU.

WALES Strippit CORPORATION

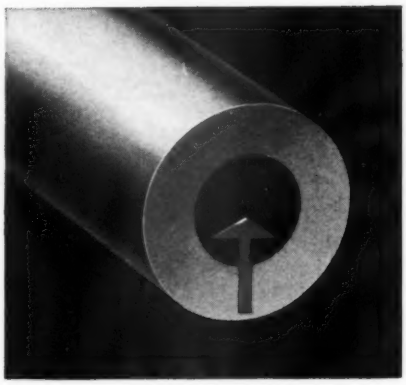
"...the Wales-Way is the PLUS-PROFIT way"

345 PAYNE AVE. — North Tonawanda, N.Y.

WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONT.



a hole here makes waste...



a hole here saves waste

Crucible Hollow Tool Steels save waste — time and money — whenever you need ring-shaped parts or tools with a center hole. For the hole is in the piece when you get it! You eliminate drilling, boring, rough-facing operations — save machine capacity for productive work.

And you can get Crucible Hollow Tool Steels in *any* of our famous tool steel grades . . . in bar lengths or saw cut to your individual requirements. They are made in practically any combination of O.D. and I.D. sizes. What's more, delivery is *immediate* with Crucible's popular KETOS oil-hardening, SANDERSON water-hardening, AIRDI 150 high-carbon high-chromium, AIRKOOL air-hardening, and NU DIE V hot work tool steel grades from warehouse stocks.

Next time you have an application with a center hole, let your Crucible representative show you how these hollow tool steel bars can save you money and time. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor — Railway & Power Engineering Corp., Ltd.

CIRCLE INFORM-A-GRAM KEY NO. 124

NEW CALCULATOR FOR Q-C'ERS

Workers at all levels of statistical quality control should be interested in a new statistical calculator by Monroe.

Termed the "Model 8N-213 Statistical," this new Q-C tool was designed and engineered to handle standard deviations (grouped and ungrouped data), linear and multiple correlation, analysis of variance and for computing control limits both modified, average and standard deviation.

The machine's capabilities include the following versatile features as standard equipment:

Automatic squaring of any number. The amount is set only once on the keyboard and the squaring is entirely automatic.

Automatic decimals. All factors are set around a constant decimal and answers appear correctly pointed off. There is no need of plugging zeroes in an auxiliary keyboard.

Automatic Veeder Counter for registering the number of items squared.

Accumulation. The Monroe statistical calculator permits accumulation of sigma x and sigma y with individual check of these multipliers and the accumulation of X^2, 2XY and Y^2 in the same operation. Positive proof needed in linear and multiple correlation is provided.

Transfer slide. A factor can be raised to its Nth power without having to write the figure on the keyboard after the first setup. When raising a number to a power ($a \times a \times a \ldots$ Nth) it is not necessary to copy results to the keyboard from the dials for subsequent calculation. The figures are automatically picked up correctly decimalized.

Automatic clearance. Both keyboard and dials clear automatically the instant the next problem is started.

Illustrated literature and detailed information may be obtained from Monroe Calculating Machine Company, Inc., Orange 98, New Jersey—**Circle Inform-A-Gram No. D3.**

SHUSTER offers most!!

3 AV

In Wire Straightening and Cutting, SHUSTER variable speed machines consistently provide the newest tested principles of operation—SHUSTER'S 90 years' know-how will cut your wire straightening and cutting costs every day!

	SHUSTER	Manufacturer B	Manufacturer C	Manufacturer D
Infinite variable speed of all feed and cutoff ranges	YES	NO	NO	NO
Electrically controlled Target and Clutch	YES	Some Models	NO	NO
Power Consumption	LOW	HIGH	MEDIUM	HIGH
Complete On-The-Job Engineering service	YES	NO	NO	NO
Flat and Shape Stock Machines available	YES	YES	NO	NO

90th year

SHUSTER — the *first* name (since 1866) in Wire Straightening and Cutting, offers *more* production features, at less investment and operating cost, than have ever been available in the field!

METTLER MACHINE TOOL, INC.
150 West Adeline Street, New Haven, Conn.

CIRCLE INFORM-A-GRAM KEY NO. 125

Replacement Needs and Potential Get Industry Attention

Tremendous incentives to both customers and the machine tool industry were highlighted in an effort to accelerate machine tool replacement at the recent Spring Meeting of the American Machine Tool Distributors' Association in Detroit. The machine tool builders studied this same subject during their Spring Meeting in Houston.

Pushing machine tool replacement in Detroit, as he did at the National Machine Tool Builders Association sessions, Louis Polk, president of the builders, pointed to the problem of increased costs for American industry in recent years in stressing that the principal compensation is increased productivity. This increased productivity comes with the use of up-to-date tools, he maintains.

At Houston, Polk said that more machine tools must be bought for modernization, not just for new plants or expansion programs.

To the distributors he emphasized that his group is going all out to convince the industrial community that the production advances they offer are real, tangible, and necessary — "not only to meet competition, but in order to continue to meet all of the nation's and our own economic obligations."

Both the machine tool industry and industry in general are headed for a "tremendous 10 years," predicted Ford Motor Company vice president Ray H. Sullivan at the distributors' sessions. He said that there is evidence that 1956 will set an all-time record of some $32-billion in business spending for new plants and equipment.

Henry R. Hanson, president of the distributors' association, does not accept the increase in machine tool orders after the Machine Tool Show as fully a result of the show. Instead, he credits "the pressures to reduce costs and increase productivity" as creating a climate for capital expenditures. The distributors were called upon by their president to see that machine tool users are made aware of the advantages new equipment provides.

Citing the recent ASTE automation survey, James E. Kelley, the distributors' general manager, called replacement programs one of the greatest challenges to the machine tool industry. According to the survey, at least 16% of all manufacturing operations can be automated, which would mean replacing over 225,000 machine tools, including grinding and finishing machines, estimates Kelley.

A special replacement panel composed of leaders in the machine tool business made these points at the Detroit meeting:

Some sort of "measure" for deciding when, where and what replacement should be made is necessary to the potential purchaser of new equipment. Factors to be taken into account in such a formula would include return on investment and quality of product, savings in labor and floor space, elimination of scrap, the movement of material, reduction in cutting tool expense, comparable cost of maintaining present equipment and the proposed equipment, and depreciation elements.

Judgment must play a part in the application of a replacement formula because factors not applicable to formula, such as lack of capability of present equipment to produce continuously within established quality limits, must also be considered.

These basic underlying principles of replacement, apply as much to the small plant as to the large one.

The panel called replacement needs and progress a responsibility of top administration and financial management as well as production specialists and engineers. Management, they said, has an obligation to be alert to replacement needs because of its responsibilities to customers, stockholders, employees, and the community.

S&E
solid carbide drill bushings
A.S.A. Standard
fully interchangeable with Standard Steel Bushings
S & E bushings are precision ground and lapped to exacting finish and tolerance, yielding the highest bushing performance with long life, (more than 50 times the life of steel bushings). This in turn cuts down-time to a minimum, increases tool wear life and provides the users with the highest quality bushing at the lowest production cost.
Ask for illustrated bulletin No. 102
S&E
MACHINE PRODUCTS INC.
Plant and General Offices: Bridgeport, Michigan
Sales Offices in all Principal Cities

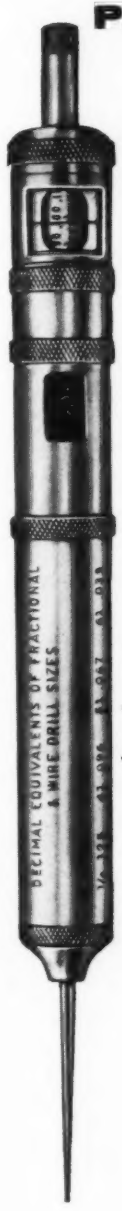
CIRCLE INFORM-A-GRAM KEY NO. 126

CHECK HOLE DIAMETERS IN FIVE SECONDS

. . . to accuracy of .0005"

with KWIK-CHEK®

PRECISION HOLE GAGES



Now Kwik Chek Precision Hole Gages with built-in Hamilton accuracy and precision enable you quickly to read your way to quality control of small drilling and punching operations.

Set of 3 small-diameter gages gives you a reading range of .025" to .380". Precision-built clutch locks scale at exact diameter reading.

Kwik Chek Gages cut inspection time and speed production of precision work. To the tool engineer, machinist and inspector they are on a par in importance with a micrometer.

MODEL # 20. Range .025" to .130" (illustrated full size)	**$40**
MODEL # 30. Range .130" to .255"	**$40**
MODEL # 40. Range .255" to .380"	**$40**
SET OF 3 GAGES IN FITTED CASE	**$115**

All Prices F.O.B. Lancaster

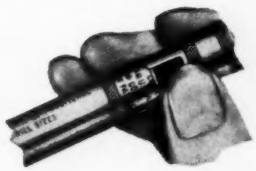
ACTUAL SIZE

Kwik Chek hole gages made to HAMILTON precision standards

- Hard chrome-plated 52-100 steel needle
- All-steel construction resists wear, corrosion
- Satin chrome finish makes markings stand out clearly
- Functional parts machined to tolerances of .0002 of an inch
- Precision clutch needs no lubrication
- Deeply knurled ring lock for easy adjustment
- Crystal 2½x magnifier permits reading to closest .0005"
- Direct reading scale graduated in thousandths

write for name of sales agent nearest you!

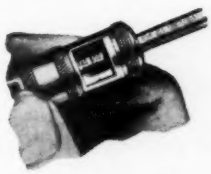
HERE'S HOW EASY IT IS TO USE KWIK-CHEK®



1 Release clutch—needle snaps into place

2 Insert needle into hole being calibrated

3 Slide barrel down until flush with work



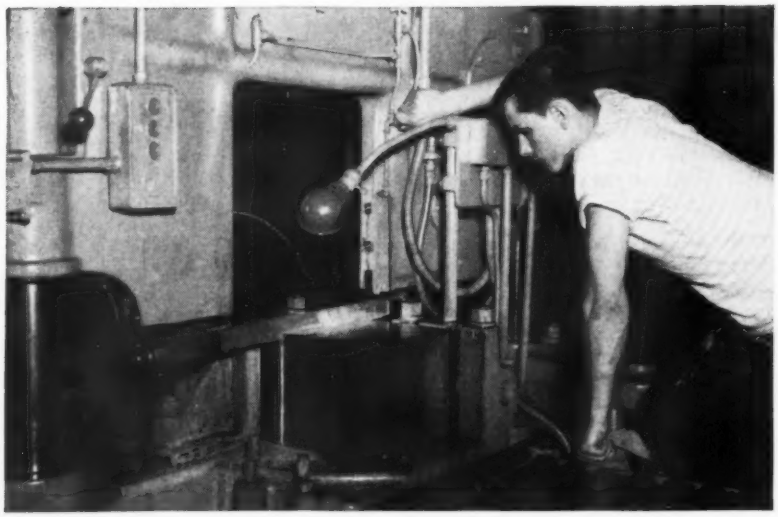
4 Remove gage—read magnified scale

HAMILTON WATCH COMPANY

ALLIED PRODUCTS DIVISION, LANCASTER, PENNA.

CIRCLE INFORM-A-GRAM KEY NO. 127

BOOST YOUR CUTTING PRODUCTION WITH BARNES ROCKET POWER BLADES



Barnes' exclusive manufacturing processes have "locked in" all the basic requirements of a top-quality hack saw blade—AND MORE!

"BARNES ROCKET BLADES," made of quality high speed steel, feature *Gradient Hardness.* The hard cutting teeth blend into a semi-hard flexible back. The result is a one piece blade with outstanding strength and safety, a blade that will withstand sudden shock loading without breaking or shattering. You are sure of a "safe," efficient blade for your toughest sawing jobs.

The inherent strength of "BARNES ROCKET BLADES" requires less tension to assure straight cuts. Elongation is held to a minimum making frequent tension adjustments unnecessary.

You can count on your local BARNES DISTRUBUTOR. The best in blades is immediately available from his stock. Through him, Barnes' up-to-date engineering and research staff stands ready to help you with any sawing problem.

The combination of immediate availability, safety, efficiency and QUALITY can't be beat.

when cutting counts BARNES *count on Barnes*

W. O. BARNES CO., INC.
1297 TERMINAL AVE. • DETROIT 14, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 128

Piston Fit Is Measured During Grinding Step

Since the beginning of mass production of automobile engines one of the most costly and time consuming problems has been in matching pistons to the cylinder bore. At one time manufacturers used as many as 18 piston classifications for a single type of engine bore; today most builders use five.

As more automotive plants are automated it has become necessary to accurately measure the pistons during the grinding operation to assure the correct number of each classification for final assembly.

One of the most promising in-process grinding gages is the Foster Electro-sizer Piston Grinding Gage, developed by Foster Engineering Corporation, 4200 N. Woodward Ave., Royal Oak, Mich. It is primarily for automated piston lines but may be readily adapted to semi-automatic production as well.

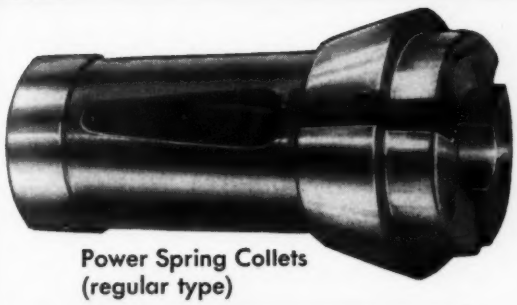
Provision has been made in the gage to check piston size at the point of major diameter only. Two signals are given by the gage: the first is to shift the machine into final slow finishing feed, the second to retract the wheelslide when size is reached.

A solenoid synchronizes the gage with the machine cycle and, during the loading and ejecting period, gage points are held open by means of a small hydraulic cylinder.

The more than 30 established uses for Moly-Sulfide lubricant additives in the automobile, aircraft, railroad, oil drilling, and steel industries caused Climax Molybdenum's domestic sales to jump 80% last year. The compound adheres well to metal surfaces, has a low coefficient of friction, and low resistance to shear.

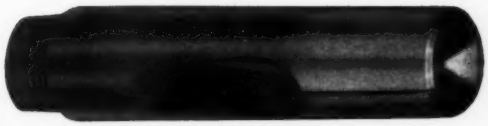
◆

Three quarters of those plants replying to a recent survey of the Associated Industries of Cleveland said that their Workmen's Compensation costs have been reduced as a result of their plant safety programs. Almost the same percentage of repliers said that their safety programs resulted in increased production.

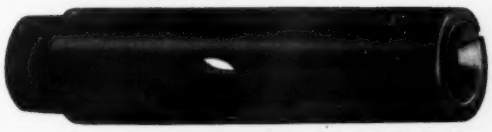


Power Spring Collets
(regular type)

Power Spring Collets
(taper nose type)



Feed Fingers (regular type)



Master Feed Fingers and Pads

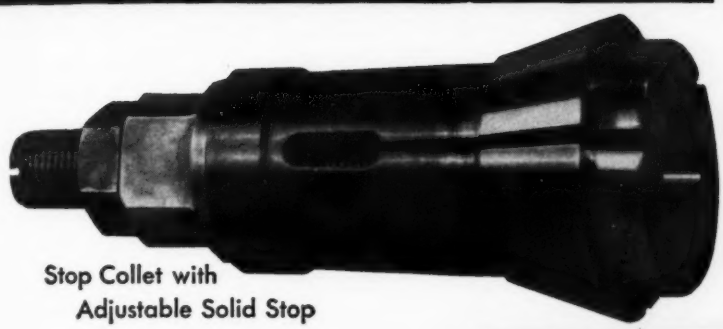
Master Feed Fingers
with Adjustable Tension

HARDINGE
ELMIRA, N.Y.

PRECISION PRODUCTS
for BROWN & SHARPE machines

For maximum production efficiency, specify Hardinge precision products for your Brown & Sharpe Automatics and Wire Feed Screw Machines. Reduce tooling costs and step up production with these and other Hardinge precision products engineered, customer-shop tested, and approved for Brown & Sharpe machines. Write for Catalog 36 — contains complete descriptions, specifications, and ordering information.

Deliveries from stock



Stop Collet with
Adjustable Solid Stop

Stop Collet with
Adjustable Spring Ejector Stop

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Immediate Stock Delivery from Elmira, Dayton, Chicago, Minneapolis, St. Louis, Detroit, San Francisco, Los Angeles, Philadelphia, Hartford, New York.

CIRCLE INFORM-A-GRAM KEY NO. 129

New Dimensional Standards Established for Gage Blocks

First major improvement in gage block accuracies in 40 years meets realities of today's precision tolerances . . . overcomes inadequacies of finest blocks previously available

By RAY GIERLICH, Gage Division The DoAll Company, Des Plaines, Ill.

Here is What Has Been Done

- **New laboratory gage block Grade AAA established with accuracy of *plus or minus one-millionth inch per inch of length*—the finest gage blocks ever manufactured commercially.**
- **Grade AA blocks (±.000002″) reduced in price as much as 70%, permitting wide usage for routine inspection work.**
- **New accuracy of plus .000004″, minus .000002″ established for Grade A blocks, with prices reduced below that of Grade B. (National Bureau of Standards tolerance for Grade A blocks is ±.000004″ per inch. The new tolerance of two-millionths (.000002″) on the minus side affords a more accurate block and provides two-millionths cushion for wear.)**
- **Grade B sets (±.000008″) discontinued on the basis of their inadequacy for close tolerance measurement.**
- **New optical surface finish (guaranteed 0 to 0.09 RMS microinches) established for all blocks, providing superior accuracy and wear life.**
- **Every block is accompanied by a Certified Inspection Report stating deviation from nominal size.**

COMPLETELY NEW standards for gage blocks have been established by The DoALL Company after a comprehensive appraisal of modern measurement needs. They represent the first basic improvement in gage block accuracies since World War I, when .001″ was a high degree of precision.

Consider .0001″, a common tolerance today. The checking gage must be accurate to .00001″—equal to or better than the accuracy of many gage blocks in common use! For example, a new one-inch gage block is actually acceptable as "B" Grade if accurate to ±.000011″ including observational error. A two-inch block could have a permissible error amounting to 20% of the tenth (.0001″) tolerance. The error in a stack of such blocks would be prohibitive.

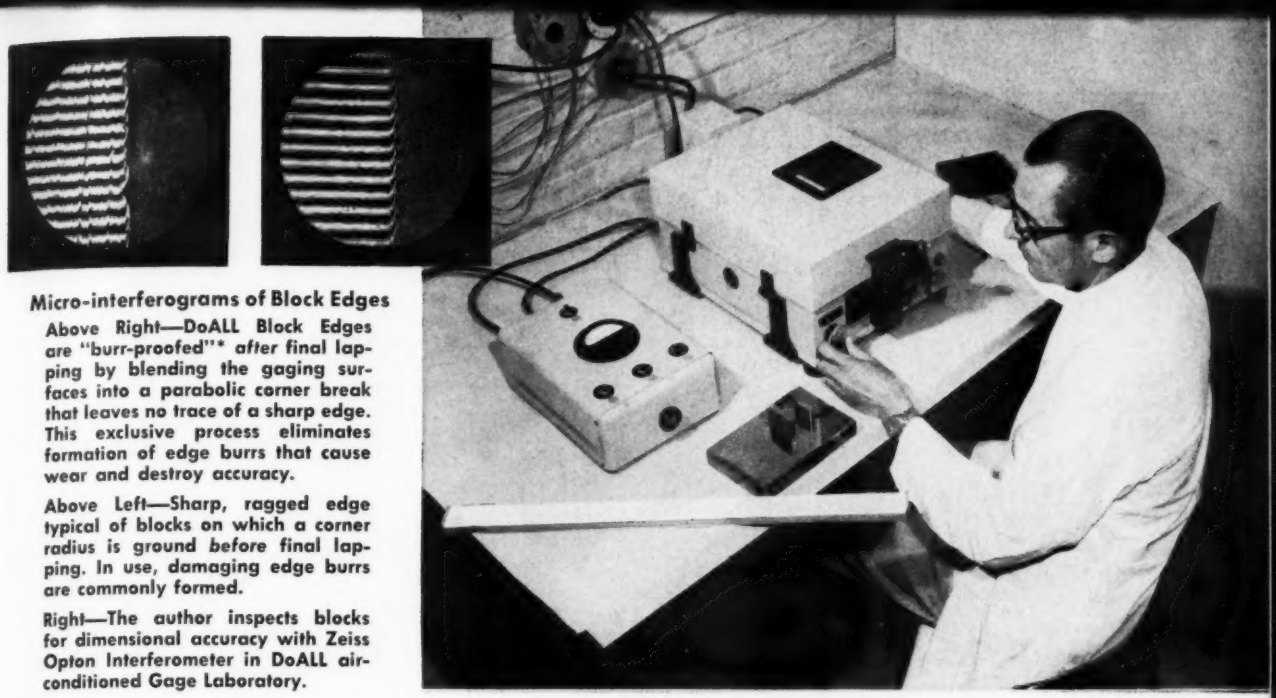
When tolerances of 75, 50 and even 25 millionths are specified, the need for better gages is instantly apparent.

As summarized at the left, DoALL has discontinued manufacture of Grade B blocks and has standardized on the grades listed in the following table.

New Standards for DoALL Gage Blocks

Grade	Tolerance per Inch of Length	Flatness	Parallelism	Surface Finish Microinches RMS
"AAA"	+.000001 −.000001	.000001	.000001	0.09
"AA"	+.000002 −.000002	.000002	.000002	0.09
"A"	+.000004 −.000002	.000004	.000004	0.09

Left—New DoALL Gage Block Sets are available in AAA, AA and A grades in 20 individual square block sets and 22 rectangular block sets ranging in sizes from 5 to 121 pieces. This includes two rectangular sets in the metric system. New plastic cases are compact, easy to clean and exceptionally durable and attractive. Wear blocks are available in sets in .050″ and .100″ sizes. A complete line of accessories makes possible assembly of fixed and indicating gages for every conceivable requirement.



Micro-interferograms of Block Edges

Above Right—DoALL Block Edges are "burr-proofed"* after final lapping by blending the gaging surfaces into a parabolic corner break that leaves no trace of a sharp edge. This exclusive process eliminates formation of edge burrs that cause wear and destroy accuracy.

Above Left—Sharp, ragged edge typical of blocks on which a corner radius is ground before final lapping. In use, damaging edge burrs are commonly formed.

Right—The author inspects blocks for dimensional accuracy with Zeiss Opton Interferometer in DoALL air-conditioned Gage Laboratory.

To provide infinitesimally accurate gaging, all blocks are now accompanied by a Certified Inspection Report stating deviation from nominal size.

Optical Surface Finish

Precise calibration of DoALL Gage Blocks to these new demanding standards would be impossible without another new achievement in gage block manufacture—optical surface finish of 0 to 0.09 RMS. For comparison, a gage block with a 1.0 RMS finish cannot be measured accurately to closer than two-millionths of an inch. The new finish also eliminates the severe, wear-producing abrading action encountered when rougher blocks are wrung together, thereby greatly extending the useful life of the blocks.

New Fractional and Tenth Blocks

To further meet modern measurement requirements, three major DoALL blocks have been enlarged to increase their versatility and speed gaging. The previous 118 piece set has been increased to 121 pieces by addition of 5/64", 7/64" and 3/32" blocks. The former 83 piece set has been enlarged to 86 by addition of .100025", .100050" and .100075" blocks, while Set No. 37 now becomes Set No. 38 with the addition of a .100050" block for half tenth measurement.

Gage Maintenance Manual

Handling and wear eventually take their toll of even the finest gage blocks. Therefore, periodic inspection and calibration is required. To help gage users save time and money, DoALL has developed the first practical guide to gage block inspection in the user's own plant. Entitled "Shop Inspection and Calibration of Gage Blocks", it describes the equipment and methods required for simple inspection for flatness and wear as well as for precision calibration of blocks. Copies are available upon request.

* * *

DoALL now offers industry the most accurately made and accurately calibrated gage blocks in the world. They provide finer, faster, lower-cost dimensional quality control than has ever before been available.

Fringe lines formed by optical finish
Magnified Finishes
An ordinary microscope reveals differences in gage block finish.
Left—DoALL Block finish—guaranteed 0 to 0.09 RMS microinches. This block can be accurately calibrated by interferometry to tenths of a millionth of an inch because fringe lines are sharply defined. This fringe pattern can be seen simply by using an optical flat and monolight.
Right—Finish typical of many blocks in use today. This block cannot possibly be calibrated to tenths of a millionth because fringe lines are fuzzy and difficult to interpret.
Fringe lines formed by rougher finish

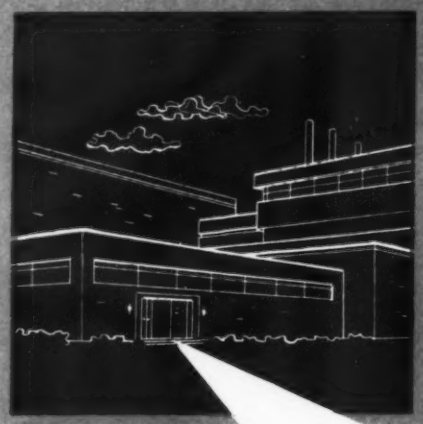
FOR COMPLETE INFORMATION—
Call your local DoALL Service Store or write The DoALL Company, Des Plaines, Illinois.

LITERATURE FREE ON REQUEST—
Call or write for a copy of the new DoALL Gage Block Catalog, listing all sets and accessories.

DoALL

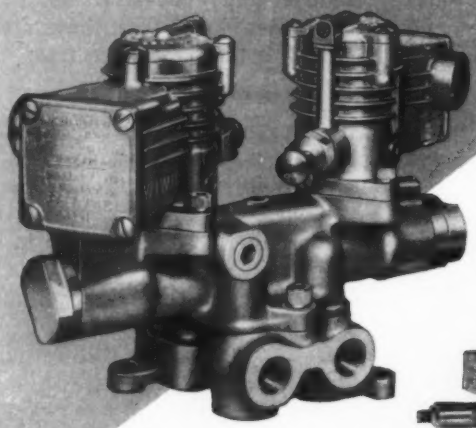
*U.S. Pat. No. 2,588,227

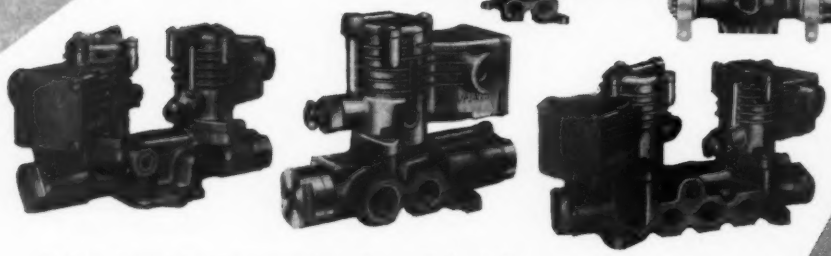
GB—16



that's Valvair

Immediate delivery from stock...





If it's valve *service* you want—immediate, off-the-shelf delivery—compare . . . and you'll buy Valvair. For we carry *in stock* one of the widest ranges of valves in the industry . . . a type and size for virtually any application involving air, vacuum and hydraulic operation.

If it's valve *performance* you want, Valvair has it there, too. For example, users report that Speed King valves are still delivering satisfactory performance after 25 million cycles.

Check your valve requirements critically. Check performance requirements, features, materials, guarantee, delivery—and you'll specify Valvair. And Valvair's stock shelf is almost as near as your telephone. Valvair Corporation, 454 Morgan Avenue, Akron 11, Ohio. AA-3248

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production gaging in microinches
with Cleveland Instruments

Bothered by gaging problems? Then get the full Cleveland Instrument story. Call us or write for catalog listings.

Bearing manufacturer maintains accuracy of tapered roller bearings with

C* Indi-Ac

exclusively

Super accuracy is a must in the manufacture of quality tapered roller bearings for machine tool spindles, special equipment and other precision applications. And to hold assembled bearings to a maximum permissible runout of .000075 inch means producing individual parts to a tolerance of 25 *microinches or less on a production line basis.*

That's why one of America's leading bearing manufacturers uses Cleveland Instrument equipment for accurate, high-speed production gaging for size, concentricity of bores, squareness to face, taper when assembled, wobble and runout. For this manufacturer has found by *experience* that Cleveland Instruments are precise, accurate, flexible and give "laboratory" standards in production work.

Another problem marked "Solved" — by Cleveland Instruments.

CLEVELAND INSTRUMENT COMPANY, INC.
735 Carnegie Avenue • Cleveland 15, Ohio

C
LABORATORY PRECISION IN PRODUCTION GAGING
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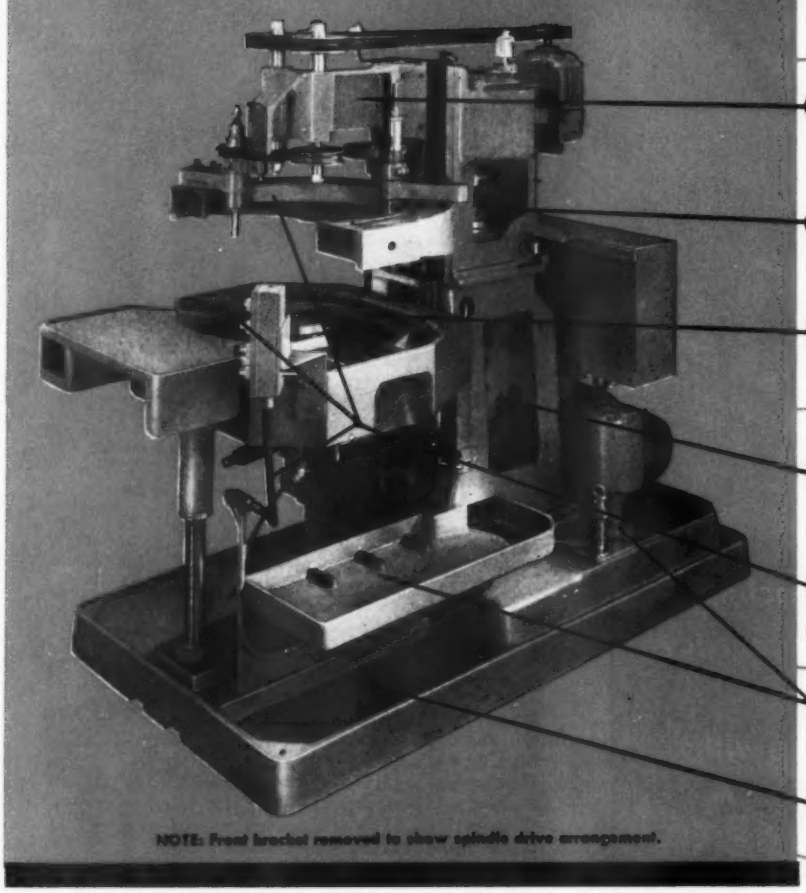
INDI-AC | PAR-AC | MICRO-AC | AUTOSORT

CIRCLE INFORM-A-GRAM KEY NO. 133

SAVE TIME AND MONEY
BY BUILDING YOUR "SPECIALS"
WITH Bodine



NOTE: Front bracket removed to show spindle drive arrangement.

BASIC UNITS

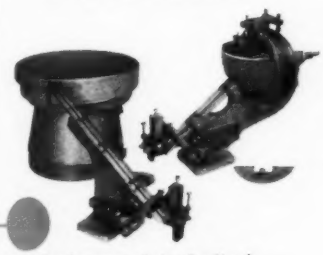
- Central and flexible jack shaft drive to vertical spindles.
- Variable, quick-change, cam-controlled, synchronized vertical motion.
- 6 standard interchangeable table indexes, from 10 to 24 stations.
- All power drive through SINGLE main shaft for simple timing and adjustment.
- Ample mounting surfaces for tooling and attachments. Tool mounting areas are standard, making all tooling interchangeable.
- Central coolant system.
- 4 standard Basic Machine sizes.

Few pieces of production equipment available today can match the practically unlimited versatility of this Bodine Basic Machine or the features it offers at such remarkably low cost. Equally important . . . while every day sees NEW developments in tooling and application, the BODINE MACHINE and standard tooling equipment remain as well-proved BASIC designs from which the "bugs" have long since been eliminated.

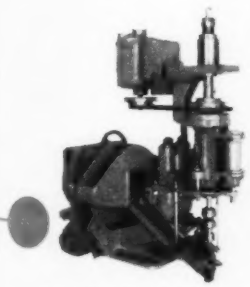
Bodine BASIC Machines are made in four sizes capable of high volume production of a wide range of small interchangeable parts, especially where multiple operations are required. The Basic Machines and spindle units may be purchased separately or in any combination by those who wish partially or wholly to design and build their own specials.

BBDS4

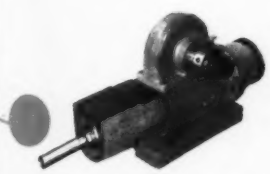
Wide range of standard spindles for drilling, reaming, tapping, threading, milling, screw-driving, etc.



Service-proved standardized automatic feed methods and units.



Screw-inserting mechanisms available as complete units.



Standardized spindles for horizontal, inverted or angular mounting.

YOUR STANDARDIZED, FLEXIBLE ANSWER TO...

HIGH PRODUCTION NEEDS

MULTIPLE TOOLING PROBLEMS

RAPID CHANGE-OVER

Time and again we hear the statement, "If we had known what can be done with a Bodine Basic Machine, we would have saved ourselves a lot of headaches in building our own specials."

Simplicity is the keynote of Bodine Basic design... simplicity combined with positive precision operation and control to assure accurate repetition of production cycles.

A single main drive camshaft times and controls all indexing and tool feed motions with full provision for simple, precise mechanical adjustment. This permits extremely accurate timing of all operations in the cycle with positive mechanical interlock. It also makes for ideal accessibility for changing of cams, aiding in rapid change-over.

Another important Bodine feature is the very broad range of standard spindle types and sizes available, which can be modified if necessary to meet essentially any practical need. Drill spindles are available in four standard sizes and are easily adjustable for a wide range of speeds. They carry a micrometer adjustment for extremely fine setting. Bodine specially designed tapping spindles can consistently maintain Class 2 (plus) fits. Lead screw units are available for Class 3 fits. Horizontal, angular and inverted spindles are fitted to many machines.

Furthermore, you no longer need to consider the investment in a "single-purpose" machine at production termination. Investigate these unusually successful Bodine Basic Machines and methods. In nine cases out of ten, we can give you a PRE-TESTED answer to your problem at far less cost. Write outlining your needs... or send us prints and samples for analysis.

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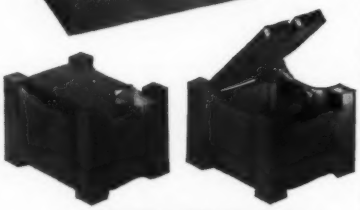
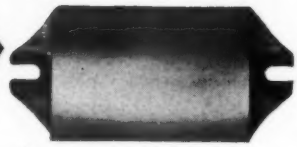
BOX JIGS

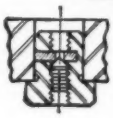


Box Jigs shown are made in either square or rectangular style in 9 sizes. Have them on hand in several sizes, use them, and watch your profits mount.

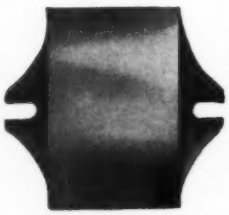
MILL FIXTURE BASES



The Mill Fixture Base shown on top is available in four sizes, the Gang Mill Fixture Base in three. Both are furnished with either standard keyways or jig-bored holes for "Sure-Lock" Fixture Keys at no extra cost. These normalized bases are precision ground, parallel top and bottom with one side finished parallel to the keyways, eliminating the delay and expense necessary in obtaining patterns, castings, normalizing and machining. Ask for full scale template drawings in your size range.



Sure Lock Fixture Keys See Page 41 of our Template Catalog



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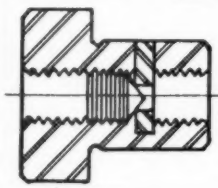

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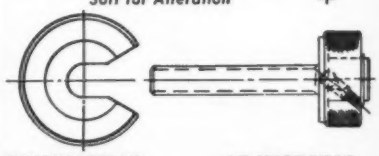

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4	24	42	62	113	133	154	178	1362	1961	2032	2101	2156	2193	2233	2291	
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7	27	45	66	116	138	159	181	1532	1972	2051	2112	2163	2196	2242	2294	
8	28	47	67	117	139	160	182	1533	1973	2052	2113	2164	2197	2261	2311	
9	29	49	69	119	140	161	183	1571	1974	2053	2114	2171	2201	2262	2312	
10	30	50	70	120	141	162	184	1572	1981	2061	2115	2172	2202	2263	2313	
11	31	51	71	121	142	163	185	1573	1991	2062	2121	2173	2203	2271	2314	
12	32	52	72	122	143	164	186	1581	1992	2071	2131	2174	2204	2272	2315	
13	33	53	99	123	144	166	187	1582	1993	2072	2132	2175	2205	2273	2331	
15	34	54	101	124	145	167	188	1583	2001	2081	2133	2176	2211	2274	2332	
16	35	55	103	125	146	171	189	1651	2011	2082	2141	2177	2212	2275	2333	
17	36	56	105	126	147	172	190	1652	2012	2091	2142	2181	2221	2281	2334	
18	37	57	107	127	148	173	191	1653	2013	2092	2151	2182	2222	2282	2335	
19	38	58	108	128	149	174	225	1931	2021	2093	2152	2183	2223	2283	2336	

EDITORIAL ITEMS

A1	A19	A37	A55	B1	B19	B37	B55	B73	C11
A2	A20	A38	A56	B2	B20	B38	B56	B74	D1
A3	A21	A39	A57	B3	B21	B39	B57	B75	D2
A4	A22	A40	A58	B4	B22	B40	B58	B76	D3
A5	A23	A41	A59	B5	B23	B41	B59	B77	E1
A6	A24	A42	A60	B6	B24	B42	B60	B78	E2
A7	A25	A43	A61	B7	B25	B43	B61	B79	E3
A8	A26	A44	A62	B8	B26	B44	B62	B80	E4
A9	A27	A45	A63	B9	B27	B45	B63	C1	E5
A10	A28	A46	A64	B10	B28	B46	B64	C2	E6
A11	A29	A47	A65	B11	B29	B47	B65	C3	E7
A12	A30	A48	A66	B12	B30	B48	B66	C4	E8
A13	A31	A49	A67	B13	B31	B49	B67	C5	E9
A14	A32	A50	A68	B14	B32	B50	B68	C6	
A15	A33	A51	A69	B15	B33	B51	B69	C7	
A16	A34	A52	A70	B16	B34	B52	B70	C8	
A17	A35	A53	A71	B17	B35	B53	B71	C9	
A18	A36	A54	A72	B18	B36	B54	B72	C10	

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A12	A30	A48	A66	B12	B30	B48	B66	C4	E8
A13	A31	A49	A67	B13	B31	B49	B67	C5	E9
A14	A32	A50	A68	B14	B32	B50	B68	C6	
A15	A33	A51	A69	B15	B33	B51	B69	C7	
A16	A34	A52	A70	B16	B34	B52	B70	C8	
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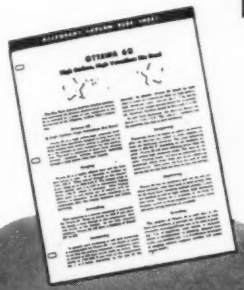

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In that service, Ottawa 60 does just exactly what it was developed to do: it performs without galling or pickup, and shows exceptional wear-resistance—as a long list of successful applications will prove to you. Two of them are illustrated above: a stainless hinge and a stainless sundae server.

But Ottawa 60 is a top performer on any draw die application! Also illustrated above are the two draws on a transformer housing of .037″ gauge SAE 1010 strip. After more than 25,000 pieces—*over 12 times any previous runs*—there was still no sign of pickup, or of wear on the Ottawa 60 punch or die.

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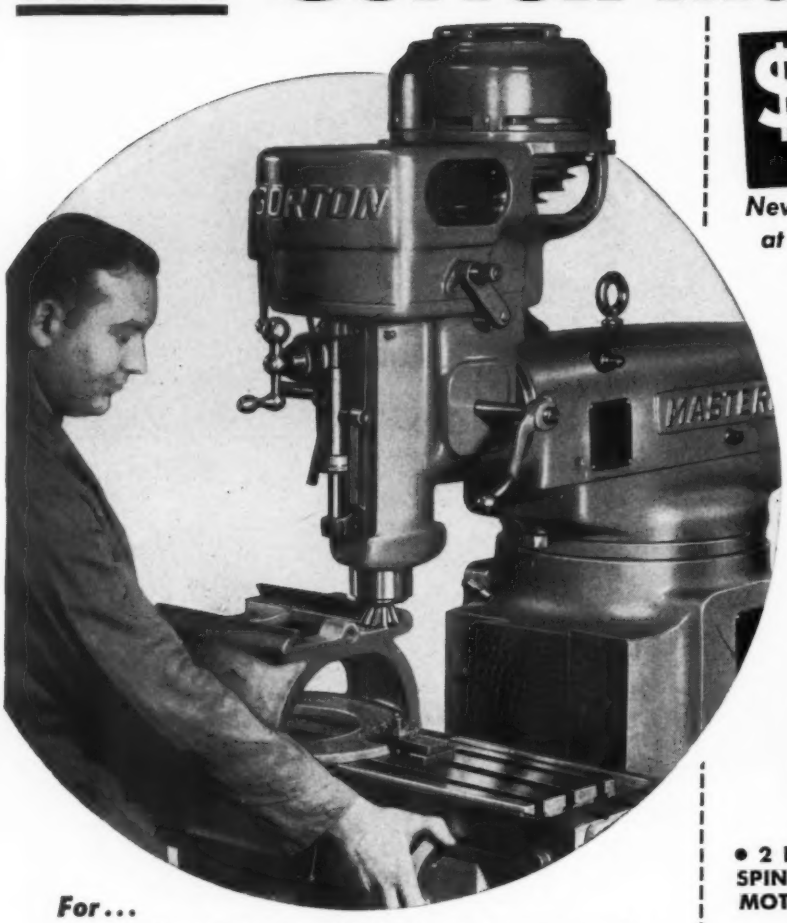

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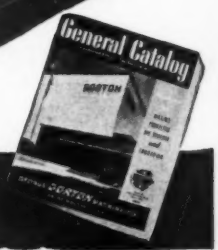
Ask for special bulletin, No. 2699, on new Gorton Mastermil and for general catalog, 1205-1655, covering the entire Gorton line.



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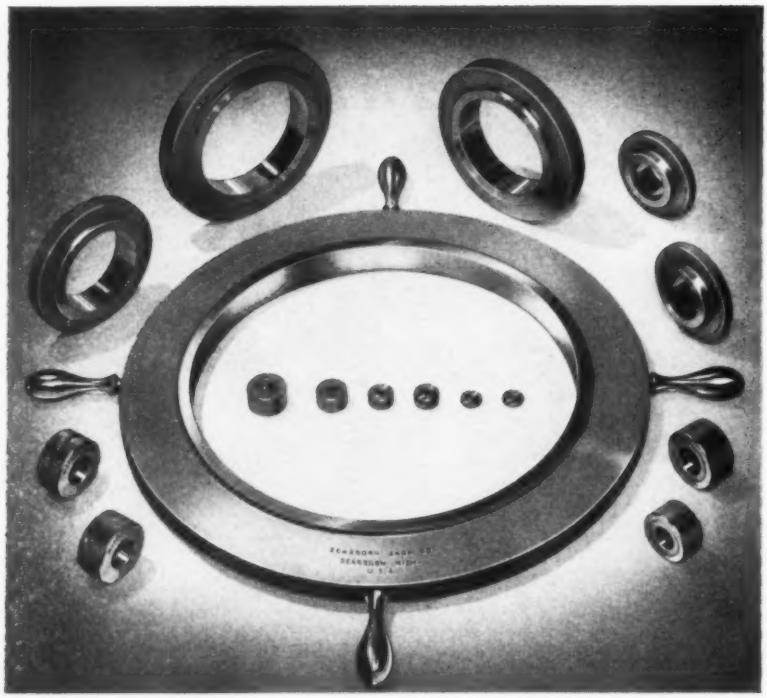

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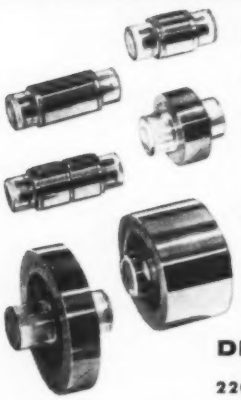

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Reversible Cylindrical Plug Gages
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Special Gages by Dearborn

CIRCLE INFORM-A-GRAM KEY NO. 140

Dual Chamfering of Valve Seats With Carbide Tool

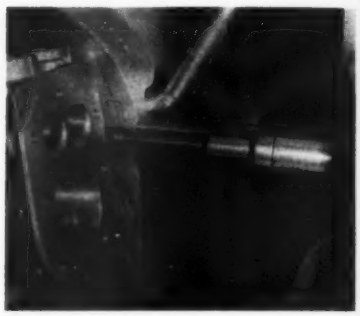
A 70% reduction in chamfering time on cast alloy valve seats was obtained by D. W. Onan and Sons, Inc., Minneapolis, Minn., after converting from a grinding operation to a machining process employing Kennametal solid square boring tool blanks.

The operation consists of finish chamfering two 15/16" ID inserted valve seats on single cylinder engines for portable power plants.

Grinding had presented three major problems: (1) requirement of a variety of wheel sizes; (2) lack of rigidity in setup; and (3) constant maintenance for proper wheel angles.

Now, using the machining process, the job is performed more economically and at an increased rate of production.

On the initial run, with Kennametal tooling, 450 valve seats were completed with each tool prior to any cutting position change. A 100% pressure test did not uncover a single failure.

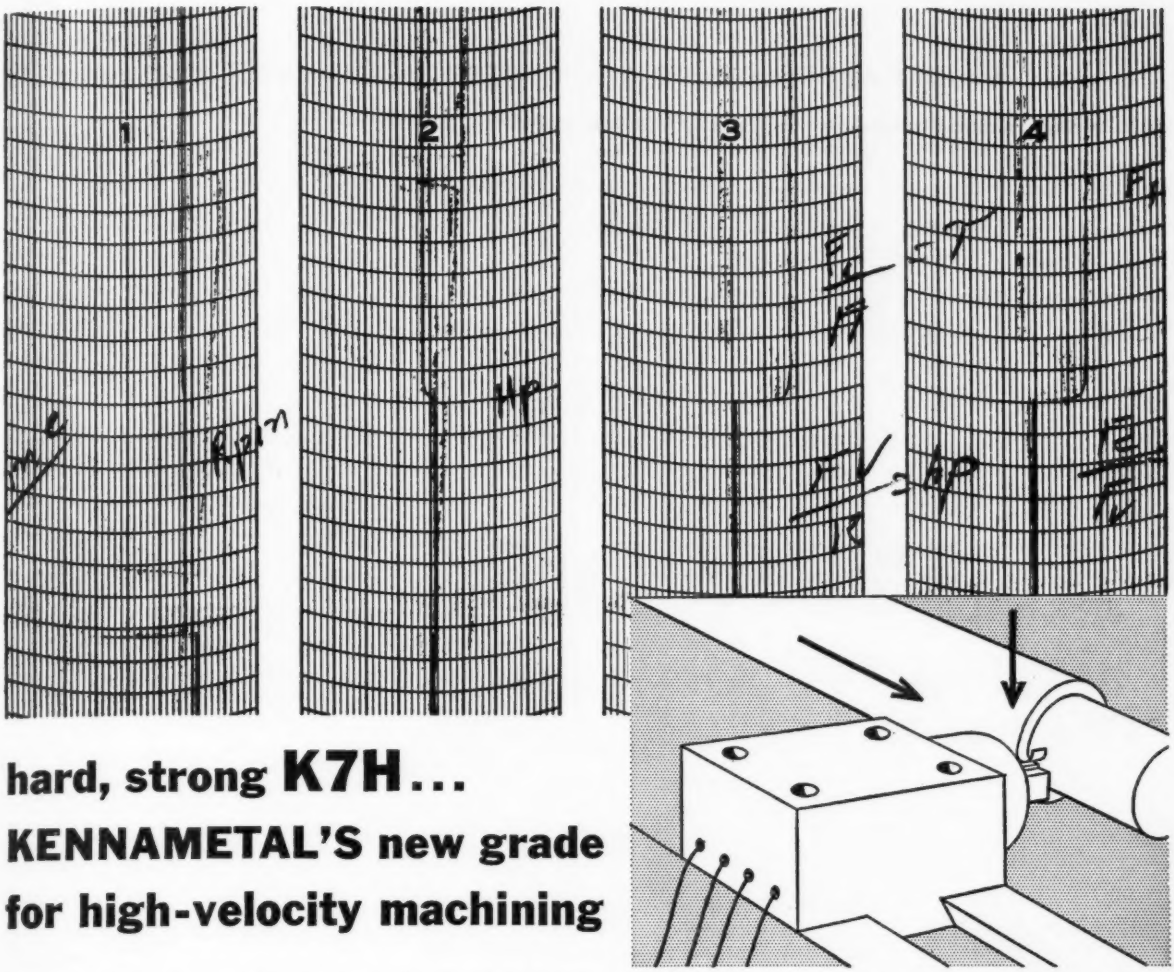


The new setup consists of two special chamfering bars with pilots which enter the full length of the valve guides before the cut is started. Depth adjustment is provided by an adjustable nut at the shank end of the bar. A special head for driving the bars was designed at the company plant.

The chamfering tools are grade K8, Kennametal style SS610, solid square boring tool blanks, $\frac{3}{16}$" square and $1\frac{1}{4}$" long. The tools slip into square hole sleeves which are sweated into the bars, providing a 5° negative rake and cutting relief angle.

An Ex-Cell-O machine is used for the operation at a feed of 0.002 ipr and 200 sfpm. The total depth of cut is $\frac{1}{32}$".

When the cutting edges become dull the tools, produced by Kennametal Inc., Latrobe, Pa., are advanced so as to provide as many as 30 new cutting edges per tool without any regrinding. Replacement is economical.



hard, strong K7H... KENNAMETAL'S new grade for high-velocity machining

In lab and shop tests, Kennametal* Grade K7H has proved to be a real "work horse" for high-velocity machining.

It's a genuine carbide—the hardest ever offered by Kennametal (93.5 Rockwell A).

It's strong—two to three times the strength of non metallic cutting materials . . . strength to resist chipping and cratering . . . strength to trace and cut to a shoulder . . . strength to stand up to normal shop abuse without "babying."

It's versatile . . . has the stamina to cover the range of feeds and depths of cuts for modern high-velocity finishing of steel alloys and the new hard-to-cut materials. Grade K7H even takes casting "skin" and forging scale in stride on light cutting—another indication of its strength and stamina.

In the Lab—with tool post dynamometer:

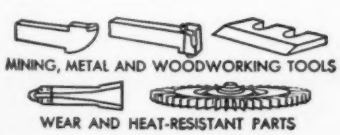
Compared with other carbides at high velocity, Grade K7H showed these results: *Test No. 1* (without coolant)—K7H performance, cutting 29-32 Rockwell C steel, indicated 27 times longer life; *Test No. 2* (with coolant)—K7H showed 28 to 1 better performance (also on 29-32 Rockwell C materials) than the control carbide grade; *Test No. 3* (without coolant)—cutting 37-39 Rockwell C steel, Grade K7H showed considerably higher resistance to wear than other carbides.

In the Shop—production runs:

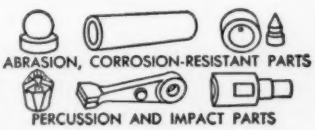
Compared with non metallics, and long-established carbides on high-velocity finish machining of SAE 5135 170-207 Bhn., Grade K7H averaged 1000 gears per cutting edge while other carbides produced only 350 pieces, and ceramics broke down at 400-450 per edge.

These tests show that Kennametal Grade K7H is truly the "work horse" for high-velocity machining as we know it today. Why not ask a Kennametal tool engineer to demonstrate Grade K7H in your operations. Or write for complete information. Address KENNAMETAL INC., Latrobe, Pennsylvania. P-5932

*Registered trademark



INDUSTRY AND KENNAMETAL ...Partners in Progress



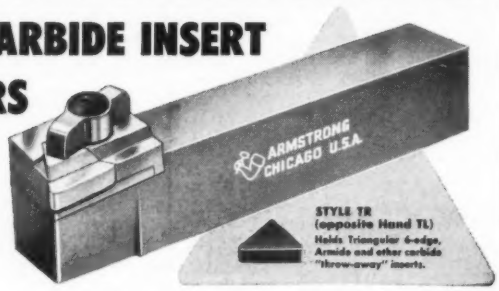
CIRCLE INFORM-A-GRAM KEY NO. 141

For Ease and Convenience Use TOOLING and PRODUCTION Inform-A-Gram Cards

Hollow Milling with Jones & Lamson die heads is made possible by buying the proper turning chasers. These die heads can be adapted to multiple turning and contour forming applications as well as straight or taper plain turning. Read all about it in Form 5433 from Jones & Lamson Machine Co., Thread Tool Div'n, Springfield, Vt., or —
Circle Inform-A-Gram No. B1.

Facilitate Production with an electrical safety control system for machines with mechanical tripping mechanisms. Security Controls, Inc., 268 Franklin St., Buffalo 2, will supply Bulletin SCI-200-1 giving wiring and components for the SCI-200-1 electrical safety control system and containing information on the system.
Circle Inform-A-Gram No. B2.

New
ARMSTRONG
Armide CARBIDE INSERT
TOOL HOLDERS



Embody...Convenience, Economy Simplicity and Strength based on these superior features:

- IMPROVED CLAMPING METHOD — speeds indexing of Inserts.
- REPLACEABLE SEAT of Hardened Tool Steel — protects shank and provides flat base to prevent damage to inserts as they are clamped in position.
- SHANK of Heat Treated Alloy Steel — gives extra strength and rigidity.

A slight turn of a single screw permits rapid indexing of the ARMIDE insert—reducing down time to a minimum.

The use of ARMIDE "throw away" inserts provides the economy of multiedged inserts—triangular inserts have six, square inserts eight cutting edges. These are available in Utility or Precision finish and in three grades of ARMIDE: 350, 370 or 883.

Protection to the shank is given by the replaceable tool steel seat which prevents wear and damage to the shank and provides a flat base for the insert reducing the possibility of damage to the insert as it is clamped in place. A relief groove is ground into the seat providing clearance when a dulled insert with "built up" edges is turned over.

ARMSTRONG ARMIDE Carbide Insert Tool Holders are furnished in two styles and three sizes. Complete data on these tools is given in Bulletin CIT, mailed on request.

Buy ARMSTRONG TOOLS from your Industrial Distributor

Write for catalog

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
5220 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

CIRCLE INFORM-A-GRAM KEY NO. 142

Micrometers, Bore Gages, and Vernier Calipers are among the precision measuring tools described and illustrated in a new catalog. Also covered are height gages, dial indicators, surface and angle plates, parallels, dial test indicators, straight edges, a caliper-divider set, vernier protractors, the Dialsink, and the Surfsink. Ernest E. Diener Co., 4779 Korte Ave., Dearborn, will issue copies of Catalog 1956, or —
Circle Inform-A-Gram No. B3.

The Man-Au-Trol Conversion Unit is discussed in a catalog from The Bullard Co., 286 Canfield Ave., Bridgeport 2, Conn. This attachment converts Model 75 Cut Master vertical turret lathe from a manually operated machine to a completely automatic production unit. The attachment's function or program control drum controls and initiates any function the machine is capable of performing.
Circle Inform-A-Gram No. B4.

A New Line of Colored Templets and colored continuous layout tapes has been announced by Repro-Templets, Inc., Oakmont, Pa. They provide a new method of color-coding master layouts, production control charts, etc. The color templets on white acetate don't reproduce. The continuous transparent color tapes are reproducible and consist of 3 groups of design. For more information, get a brochure from the company, or —
Circle Inform-A-Gram No. B5.

Bring Drill Press Accuracy Right to the Job with the Portomag portable magnetic drill press. It features electro-magnetic power control switch, heavy-duty power capacity for positive positioning, and demagnetizing switch. In addition to being a drilling and reaming tool, the drill press has an optional feature for tapping work. Details are in a bulletin issued by Portomag, Inc., 1511 E. Nine Mile Rd., Ferndale 20, Mich., or — **Circle No. B6.**

Cemented Oxide Blanks and Inserts, Grade 0-30, are the subject of Bulletin GTO-102 from Carboloy, Dept. of General Electric Co., Detroit 32. The bulletin details both sizes and shapes of the cemented oxide that are available. It also describes holders and accessories for applying cemented oxide blanks in machining.
Circle Inform-A-Gram No. B7.

TOOLING and PRODUCTION'S Inform-A-Gram Section is a CARDload of Information

Grinding Wheels for use on tools and cutters are featured in Bulletin T-855 prepared by Electro Refractories & Abrasives Corp., Grinding Wheel Div'n, 344 Delaware Ave., Buffalo, N. Y. Vitrified and resinoid bonded grinding wheel specifications are listed for tool room applications. The bulletin highlights the economies which can be gained through the use of these wheels by reducing or eliminating diamond wheel usage.
Circle Inform-A-Gram No. B8.

How to Reduce the Tool Cost of Producing a Gear is described in the booklet, "Certified Unground Hobs." Certified unground hobs are almost 3 times as accurate as ordinary unground hobs and have a lower original cost and increased sharpening life. In addition, the booklet describes these hobs and explains the method by which a gear manufacturer can determine whether they can or cannot be used. Illinois Tool Works, 2501 N. Keeler Ave., Chicago 39, or — **Circle No. B9.**

Ball and Roller Bearings are the subject of a 16-page catalog. Included are roller thrust, ball thrust, thrust, journal roller, and industrial roller bearings; metal balls; steel rolls; and special bearings. Each type is illustrated and described complete with specifications. The Gwilliam Co., 360 Furman St., Brooklyn 2, will provide copies of Catalog 27, or — **Circle No. B10.**

Six Types of Relays for industrial applications are detailed in "Relays," an illustrated bulletin from Stromberg-Carlson Co., 100 Carlson Rd., Rochester 3, N. Y. Information is given on Types A, B, C, and D relays, Type 340 polar relays, and relay mountings and covers. All types of relays are available with tropicalization, if required.
Circle Inform-A-Gram No. B11.

Electrically-Driven Industrial Trucks are the subject of a 16-page illustrated catalog. Included are trucks ranging in size and load capacity from the operator-led Transporters to Giant Skylift fork and ram trucks capable of lifting loads up to 100,000 lbs. In addition to complete specifications, the aisle width and turning radius required by each type of truck are given. The catalog is made available by Automatic Transportation Co., 149 W. 87th St., Chicago 20, or —
Circle Inform-A-Gram No. B12.

Reduce Coil Loading Time and increase production with U. S. multi-roll cradles. Two sizes are available — Model ACC-1-9-C for material up to 9" wide and Model ACC-1648 for materials up to 16" wide. Bulletin 95 giving details on the Multi-Roll cradles and pointing out their features is issued by U. S. Tool Co., Inc., Ampere (East Orange), N. J., or —
Circle Inform-A-Gram No. B13.

Produce Precision Smooth Holes from the solid in cast iron, aluminum, bronze, and steel parts at feeds up to 60 in/min with Starbore carbide drills. An engineering data catalog containing application information, line drawings, and descriptions is available from Star Cutter Co., 34500 Grand River Ave., Farmington, Mich., or —
Circle Inform-A-Gram No. B14.

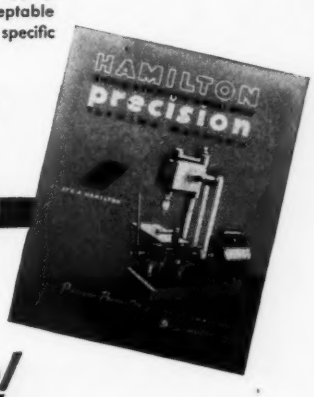
5203-B

IT'S A HAMILTON

INDEED

There is no way under the sun to do small, precision tapping with "production" speed, satisfactory tap life and acceptable accuracy, other than to use a tool designed for the specific purpose.

THE *Hamilton* SUPER-SENSITIVE SMALL HOLE TAPPING MACHINE IS SUCH A TOOL!



WANT ALL THE FACTS ?

Write for Hamilton Bulletin No. 5203. Address The Hamilton Tool Company, 832 South Ninth Street, Hamilton, Ohio.

IT'S A *Hamilton Tool*
USE IT WITH CONFIDENCE

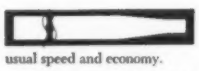
CIRCLE INFORM-A-GRAM KEY NO. 143

Boring, Milling, Facing and Screw-Cutting Operations are performed by the B85 horizontal boring and milling machine. The specifications are listed and the features of the machine are detailed in a bulletin supplied by Parker Machine Co., 158 Pioneer St., Brooklyn, or —
Circle Inform-A-Gram No. B15.

Operation, Tooling, Lubrication, capacity, and drive arrangements for a complete line of hand feed threaders are covered in a 12-page booklet. Specific descriptions of each of the four types of machines shown are given. Included is a list of the various types of cold heading equipment, power presses, wire mill equipment, and rolling mill machinery available. Request Circular 931-A-2 from Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. ,or — **Circle No. B16.**

Leigh Carbide Scribers and Pocket Magnets are the subject of Bulletin 4356 from Spring Specialty Co., 23 N. 5th Ave., Maywood, Ill. These pocket tools are used in tool rooms, production plants, and sheet metal shops.
Circle Inform-A-Gram No. B17.

ROTARY SWAGING
is fast and economical



A wide variety of work can be performed by Torrington Rotary Swaging Machines – with unusual speed and economy.

The swaging time to shape this section of 1¾" tubing is only 6⅝ seconds. And the operation is easily and accurately performed by unskilled labor.

If your operations include reducing, tapering, pointing, sizing, bonding, forming inside contours or threads – rotary swaging offers many advantages over other methods.

Write today for our informative booklet on Torrington Rotary Swaging Machines. Or even better, ask to have a technical representative call to show you where rotary swaging can achieve new savings in your plant.

THE TORRINGTON COMPANY
Swaging Machine Division
6 North Street, Torrington, Conn.

Advantages of Rotary Swaging—

1 **Savings in material**—swaging is chip less—shapes the work instead of cutting metal away.

2 **Saving in labor**—swaging can be done by unskilled labor.

3 **Improved products**—swaging improves grain structure, tensile strength, resiliency and finish. Produces work accurate to ± .001" and better.

Torrington Job-Tested Swaging Dies—for the best in swaging machine dies—at economical prices, contact Torrington. All Torrington dies are job-tested before shipment.

90th

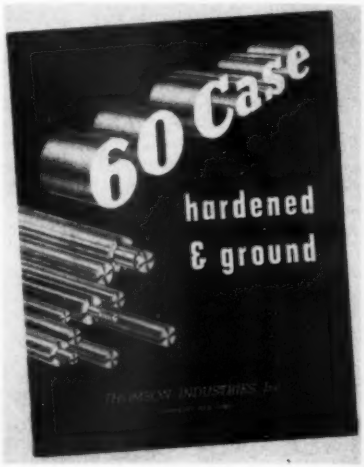
TORRINGTON ROTARY SWAGING MACHINES

Makers of Torrington Needle Bearings

CIRCLE INFORM-A-GRAM KEY NO. 144

A New Tool Steel Stock List is being offered by The Uddeholm Co. of America, Inc., 155 E. 44th St., N. Y. The booklet lists over 2800 individual sizes of air, oil, and water hardening tool steels stocked by the company. Also included is a tool steel selector chart which classifies each tool steel by general application and gives SAE numbers, information on analyses, heat treating and mechanical properties, etc.
Circle Inform-A-Gram No. B18.

"60 Case" Material covers long, round, and hardened bars for use as guide rods, shafts, rolls, piston rods, axles, etc. The material is AISI 1060 steel which has a surface hardness close to 60 on the Rockwell C scale. "60 Case" material economically solves the problem of fabrication of long-round parts with a hard wear surface. Literature on this new material is available from Thomson Industries, Inc., Manhasset, N. Y., or — **Circle No. B19.**



11 Typical Applications of 6 different types of adhesives, coatings, and sealers are listed in a catalog from Adhesives & Coatings Div'n, Minnesota Mining & Mfg. Co., 423 Piquette Ave., Detroit 2. These products are used in the truck and bus industry to insulate equipment against noise, heat, and cold; and lengthen the operating life.
Circle Inform-A-Gram No. B20.

High Speed Utility Drills have been designed and heat treated for applications requiring sturdier, shorter drills than available in conventional fractional letter or wire drills. For tougher portable body and sheet metal drilling jobs, these drills with the shorter flute and overall length have greater rigidity. These drills are covered in Form 137-R from Chicago-Latrobe, 411 W. Ontario St., Chicago 10, or —
Circle Inform-A-Gram No. B21.

Aerate Any Coolant with an aerator which decreases the specific gravity of the coolant allowing the coolant to cover more area and cling to the work and tools. Capable of operating in any position on the coolant pipe, the unit stops coolant splash. Details on the unit are found in a circular from American Aerator Co., P.O. Box 612, Clifton, N. J., or — **Circle Inform-A-Gram No. B22.**

"How to Save Thousands of Dollars" illustrates and describes many types of environmental test equipment manufactured by Murphy & Miller, Inc., 1326 S. Michigan Ave., Chicago. The company wants to prove that the reduction of maintenance costs, interrupted tests, delays in production, and erratic test conditions will result in savings which will more than compensate for the higher purchasing cost. **Circle No. B23.**

Quick Change Tools are the subject of literature from The Portage Double Quick Tool Co., 1046 Sweitzer Ave., Akron, O. Various types of holders and adapters are listed. In addition to the tool listings and illustrations, typical tool applications are shown for horizontal boring, drilling, and milling machines, turret lathes, vertical mills, and small mills. A cut-away view shows the design features. **Circle No. B24.**

An Automatic Painting Machine features an oscillating gun which can be set to describe an arc, to paint either flat, convex, or concave shaped parts. Model PC 10 is a self-contained completely enclosed machine for single color decorating of small and medium size parts, with painting areas up to 6" x 8". It is also available combined with an automatic mask washer. For Form 604 describing the machine, contact Conforming Matrix Corp., 416 Factories Bldg., Toledo 2, O., or — **Circle Inform-A-Gram No. B25.**

Master Feed Fingers with adjustable rubber inserts for automatic screw machines are the subject of a catalog available from Green Mfg. Co., 122 Prairie Ave., Rockton, Ill. Included are specifications, ordering information, and instructions for the adjustment and use of the fingers and inserts. **Circle No. B26.**

"Effect of Linear Pressure on Rubber Covered Squeeze Rolls" contains information which aids in the design, selection, and use of rolls for specific plant applications. It will enable roll users to determine how to get the most in efficiency, quantity, and quality of production while conserving the rolls. Engineering Report No. 9 is published by Rodney Hunt Machine Co., Orange, Mass., or — **Circle No. B27.**

More Than 1000 Optical Items are covered in an Optical Aids Catalog. Included are industrial quality control tools. Each item is pictured and described and the price listed. Get your copy of the catalog from Edmund Scientific Corp., Barrington, N. J., or — **Circle Inform-A-Gram No. B28.**

NOW CUT COST OF PRECISION GEAR PRODUCTION

THIS FEATURE: *"Independent* selection of speed, feed and indexing," sets the Hamilton Precision Small Gear Hobber apart from the field,

AND ENABLES the users of this machine to vary speed and feed to suit the material being machined.

THIS FACT, and a "reserve of accuracy" built into the machine, work spindle and hob spindle runout of less than .0002" as an example,

CONTRIBUTES to more gear precision with no sacrifice of gear production,

OR INCREASED gear production with no sacrifice of gear precision, ... OR BOTH!

Prices and specifications without obligation

ASK FOR FREE BULLETIN 5410

Address
The Hamilton Tool Company
832 South Ninth Street
Hamilton, Ohio

IT'S A Hamilton Tool
USE IT WITH CONFIDENCE

CIRCLE INFORM-A-GRAM KEY NO. 145

A Carbon Restoration Process for socket products and heat treated cap screws is discussed in a pamphlet released by The Chicago Screw Co., 2701 Washington Blvd., Bellwood, Ill. Photomicrographs show how these carbon restored products compare with those of lesser quality.
Circle Inform-A-Gram No. B29.

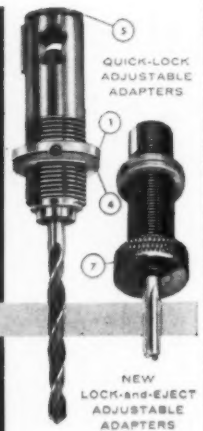
The Specialized Techniques used in small parts, high-speed die casting are explained in a catalog from DCMT Sales Corp., 80 Shore Rd., Port Washington, N. Y. In addition, the catalog deals with the supplementary, inter-related processes used along with diecasting and considers the problems entailed in setting up a diecasting department. Also illustrated is the equipment used to produce the castings shown in the catalog. **Circle No. B30.**

Measure Chisel Point, Point Angle, clearance angle, and point center with a 4-way drill point gage. An adaptor with a wide face is also available for measuring large drills. A circular from Swanson Mfg. Co., 1236 Sherman Ave., Evanston, Ill., describes the gage, or —
Circle Inform-A-Gram No. B31.

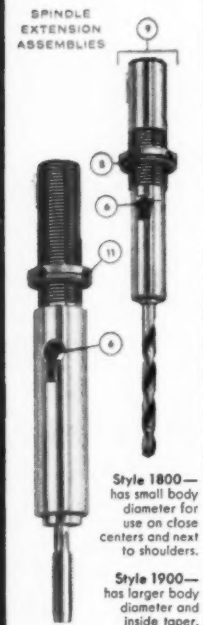
Scully-Jones Adjustable Adapters

FOR PREMIUM PERFORMANCE OF DRILLS, TAPS, REAMERS

AT NO PREMIUM IN PRICE!



These benefits . . .	for these reasons . . .	result from these PREMIUM features
INCREASED ACCURACY	No "cocking" or spindle distortion	1. Top face of quick-lock nut is square with threads.
		2. Locking shoe assures even distribution of pressure on all mating threads.
	Cutting tools run true	3. Bore and shank are concentric within .002 in. gaged 6 in. from adapter.
INCREASED PRODUCTION	Faster adjustment	4. Quick-lock nut locks any place on thread by only ¼ turn of set screw.
	Faster tool changes	5. Pilot nose eliminates "binding."
		6. Keyhole-type drift slot simplifies tool ejection.
		7. New Lock-and-Eject type eliminates use of conventional drift.
LOWER TOOL COSTS	Full use of adjustable range of adapter	8. Quick-lock nut is thinner than nuts used on most adapters.
		9. Small diameter permits use on close centers.
	Reduced tool breakage	10. Keyhole-type drift slot eliminates need for hammering with conventional drift.
	Adapter lasts longer	11. Friction-type nut prevents thread damage. Set screw does not contact threads.
		12. "Stressproof" steel induction hardened to give best combination of wear resistance and toughness.
	Solve pull-out problems	13. New Lock-and-Eject type increase holding power.



Style 1800—has small body diameter for use on close centers and next to shoulders.

Style 1900—has larger body diameter and inside taper.

SCULLY JONES

Call your Scully-Jones factory-trained representative or distributor for complete information and prices.

PRECISION HOLDING TOOLS

"Precision Holding" for holding precision

Scully-Jones and Company, 1913 South Rockwell Street, Chicago 8, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 146

"The Plant Engineers' Guide to Machinery Mounting, Vibration & Noise Control" discusses such problems as machine mobility, eliminating floor bolts, leveling machines, eliminating rejects, and controlling vibration and noise. The bulletin shows by means of case histories how the problems are being solved by using isolation media like steel springs, cork, and rubber. A selector chart is inserted telling the exact cost of vibration and noise control mountings for 215 of the most commonly used openback inclinable punch presses. Copies of Bulletin K6A are available from the Korfund Co., Inc., 48-39E 32nd Pl., Long Island City 1, N. Y., or —
Circle Inform-A-Gram No. B32.

Bodymakers, Power Formers, and Duplex Seaming Presses for medium and high speed can making lines are described in a 16-page Bliss catalog. The design and construction features of all machines are given and dimensions listed. Copies of Section 3, Catalog 36-B are made available by E. W. Bliss Co., 50 Church St., New York 7, or — **Circle No. B33.**

For Effortless and Automatic Control of Magnetic Chucks use "Selectrons". A brochure gives details concerning the method of obtaining DC power from the rectifier and the principle involved in the control of holding power and the automatic demagnetization of chuck and work. A variety of installations is shown and the various capacity ranges of the "Selectrons" are given. Copies of Form 53-20 are released by The Do-All Co., Des Plaines, Ill., or —
Circle Inform-A-Gram No. B34.

The Reasons Why Dust Collectors Are Essential to Industry, how unitized collectors save money, and how they can be used are found in a 16-page Torit catalog. The complete line of Torit cabinet cloth filter and cyclone separator type dust collectors is shown and described. Photos show actual installations and products. For copies of Catalog 39, write to Dept. KP, Torit Mfg. Co., 287 Walnut St., St. Paul 2, Minn., or —
Circle Inform-A-Gram No. B35.

Fluoroscopic X-Ray Examination of Steel and other metals with high density and absorption characteristics is discussed in a new bulletin. The bulletin gives engineering data on industrial applications of the Norelco industrial image intensifier. Included is a curve showing penetrameter-sensitivity plotted against material thickness, and other illustrations. North American Philips Co., Inc., 750 S. Fulton Ave., Mt. Vernon, N. Y., or —
Circle Inform-A-Gram No. B36.

Speed Production and ease maintenance with Bux magnetic tools. A brochure illustrates and describes magnetic drill vises, portable magnetic plate clamps, and portable magnetic drill presses. Also shown are actual applications of the tools. Further information is contained in the brochure, "Bux Magnetic Products," from Buck Mfg. Co., 100 Roberts Rd., Los Gatos, Calif., or —
Circle Inform-A-Gram No. B37.

Dearborn Quality Controlled Gages produced to AGD standards are highlighted in a 48-page illustrated catalog. Standard gages offered include plain cylindrical ring gages, plain plug gages, progressive plug gages, reversible plug gages, tapered plain plug, and ring gages and master setting discs. Also included is a separate section covering special, non-standard gages built to customer specifications and a technical data section. Dearborn Gage Co., 22038 Beech St., Dearborn, Mich., will fill letterhead requests for the catalog.

"Pivot Polishing" describes the process of sizing and finishing high precision shafts and pivots. Also included are descriptions of the Hauser pivot burnishing machines complete with technical data. For your copy, contact Carl Hirschmann Co., Inc., 30 Park Ave., Manhasset, N. Y., or —
Circle Inform-A-Gram No. B38.

Pinpoint and Correct Mechanical Trouble in Rotating Machinery with a continuously variable filter. IRD Model 1064 variable filter is used with IRD vibration analyzers to spot chatter in grinders, eccentricity in turning and boring operations, bearing failures in high-speed machinery, etc. A Filter Bulletin pointing out the ways to locate and solve vibration problems is made available by International Research & Development Corp., 810 Thomas Lane, Columbus, O., or —
Circle Inform-A-Gram No. B39.

Three Standard Sheets showing the I.D. exhaust type trepanning tool, the O.D. exhaust type tool, and the starting tool for use with the O.D. exhaust tool, have been issued by Madison Industries Inc., P.O. Box 131, Muskegon, Mich. Trepanning is recommended for larger diameters or a reasonably long run production.
Circle Inform-A-Gram No. B40.

Straight or Crown-Shave External Spur and Helical Gears from 3" to 24" pitch dia with Model GCP-24-in gear shaving machine. The machine will also shave internal spur and helical gears. A catalog contains operating principles and details the cutter head and spindle and the machine table and drive. Request Catalog S-55-11 from National Broach and Machine Co., 5600 St. Jean Ave., Detroit 13, or —
Circle Inform-A-Gram No. B41.

Collets for Lathes, Milling Machines, and Grinders are detailed in a new Sutton bulletin. A list of the machines and their respective collet numbers is given to facilitate ordering the correct collet. Get your copy of Bulletin 10 from Sutton Tool Co., Sturgis, Mich., or —
Circle Inform-A-Gram No. B42.

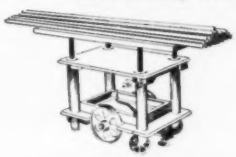
5603

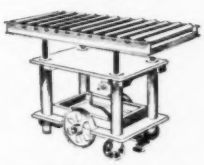
NOW!

NEW Convenience
NEW Capacities
NEW Designs

PORTELVATOR®

The Handy HAMILTON Portable, Elevating Table





NEW provision for increasing table area!

NEW provision for raising and lowering overhanging loads!

NEW convenience in maneuvering! Six wheel models roll easier . . . turn shorter.

NEW overhanging conveyor tops!

More stamina, more versatile performance than ever before

NEW FREE LITERATURE illustrates and describes all! Write for Bulletin P-5603. Address, The Hamilton Tool Company, 832 South Ninth Street, Hamilton, Ohio.

IT'S A Hamilton Tool
USE IT WITH CONFIDENCE

CIRCLE INFORM-A-GRAM KEY NO. 147

The Ther-Monic Rental Plan is covered in a bulletin from Induction Heating Corp., 181 Wythe Ave., Brooklyn 11. The monthly rental provisions of the rental plan enable the leasee to acquire new high frequency heating equipment. Thereby he will gain precise automatic control and high production rates.
Circle Inform-A-Gram No. B43.

Marking Dies and Stamps are highlighted in 2 bulletins released by Markall Products Co., 27101 Knickerbocker Rd., Bay Village, O. Premier-Safety industrial heavy duty dies made from special-alloy steel are available in sizes 1/32" through 1". The company also supplies custom-made product marking tools and offers a precision engraving service and an engineering service.
Circle Inform-A-Gram No. B44.

"Production Brazing and Soldering" details an economical method of high-strength assembly using Selas gas-fired automatic heat processing machines. The bulletin shows actual application of the custom-built automatic brazing machines. Get your copy of Bulletin S-1050 from Selas Corp. of America, Dresher, Pa., or —
Circle Inform-A-Gram No. B45.

GROUND MULTIPLE THREAD MILLING CUTTERS
FACE MILLS
FORM RELIEVED MILLING CUTTERS
BROACHES
CONTINENTAL DRIVE TOOLS
SINGLE POINT TOOLS
FORM TOOLS
Why These Cutting Tools are
Production Proved
Continental is an Ex-Cell-O subsidiary.
As such, we are constantly trying out new tool designs, new methods, in Ex-Cell-O's big parts production shops.
There could be no finer "proving ground" for testing new materials and new methods. There are no finer cutting tools than "Production-Proved" tools by Continental.
Call in your Ex-Cell-O representative or contact Continental in Detroit for information about them.
CTW
55-31
Continental TOOL WORKS
Division of Ex-Cell-O Corporation, Detroit 32, Mich.
CIRCLE INFORM-A-GRAM KEY NO. 148

Precision Power Torquing is possible with the Nelson torque wrench. This wrench is a machine driven tool which transmits power through the patented Magnefluid drive with a smooth, reliable, and accurate torque. A bulletin describing the tool is issued by Swift Tools Inc., 3201 S. Prairie Ave., Sioux Falls, S. Dak., or
Circle Inform-A-Gram No. B46.

10", 12", and 14" Dividing Heads have been designed to increase the flexibility and adaptability of Cincinnati knee and column milling machines. A bulletin lists their design highlights and their special features. In addition, it pictures typical workpieces that can be handled by the dividing heads. For copies of Bulletin M-1924, contact The Cincinnati Milling Machine Co., Cincinnati 9, O., or — **Circle No. B47.**

Move Heavy Equipment Economically with the Multiton roller skid with self-laying track. A bulletin gives 6 reasons for using the skid and shows actual applications. In addition, the specifications are listed. Get your copy from Stokvis-Edera & Co., Inc., 18 Secatoag Ave., P. O. Box 249, Port Washington, N. Y., or —
Circle Inform-A-Gram No. B48.

Accurately Position and Hold All Shapes for milling, drilling, reaming, etc. with the Universal precision lathe fixture which adapts single purpose machines to special jobs. A 4-page catalog pictures 5 typical applications showing how this tool can be used on engine lathes, turret lathes, grinders, and boremetics to perform machining operations on parts otherwise difficult to chuck or hold. Request Catalog LF56 from Universal Vise & Tool Co., Parma, Mich., or — **Circle No. B49.**

Designed for Accurate, Repetitive Production is a low cost flame cutting machine. No. 42 Camograph when equipped with a suitable cam, will automatically flame cut identical shapes from steel sheet or plate for production runs of any quantity. It will cut any shape that falls within a 42" dia circle. Details are in Catalog 804D from Air Reduction, 60 E. 42nd St., New York 17, or —
Circle Inform-A-Gram No. B50.

Speed, Accuracy, and Economy are features of a new single point threading lathe which incorporates the Man-Au-Cycle technique. The Man-Au-Cycle threading technique has eliminated the need for repetitive measurements. For copies of a bulletin detailing the lathe, contact Man-Au-Cycle Corp. of America, 132 — 53rd St., Brooklyn 32, or —
Circle Inform-A-Gram No. B51.

Designed for 45° Chamfering Operations on all cast iron and steel materials are Ser-Sel band-type Multicut carbide insert holders. They can also be used for turning operations when a 45° shoulder is required. Data Sheet 955-1 shows all dimensions and features of the holders which are semi-standard and use standard square type inserts. Get your copy from Wesson Co., 1220 Woodward Heights Blvd., Ferndale 20, or — **Circle No. B52.**

Single Crank Straight Side Presses have been introduced in Bulletin 64 Supplement by Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11. These presses feature

triple box section design, great shut height, long slide adjustment, and the exclusive Electro-Pneumatic clutch control. Models are available from 100 to 400-ton capacities. **Circle Inform-A-Gram No. B53.**

Problems Due to Moisture in Compressed Air and how to solve them are covered in a bulletin from Van Products Co., Erie, Pa. The Vi-Speed Dehumidi-Filter gives industry a dependable source of dry, clean compressed air for many devices and operations. It utilizes the absorptive properties of Dryolite, a noncorrosive desiccant which slowly dissolves and needs only replenishment. **Circle Inform-A-Gram No. B54.**

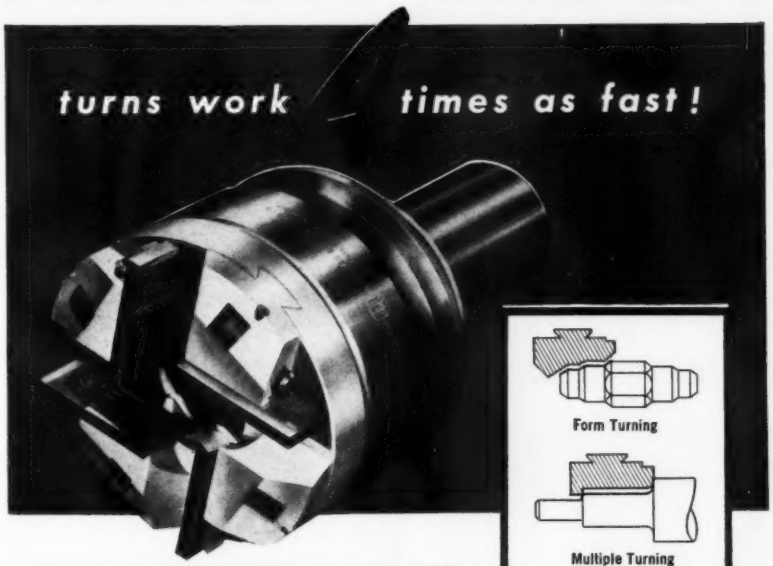
"55 Perforating Problems and Their Solutions" covers practically every type of problem involving all types of metals and thicknesses from 0.025 to 1.250. Included are many examples where stock thickness exceeds punch diameters, along with a description of the problem involved in each case, the solution, and actual production facts and costs. For your copy, write to Pivot Punch and Die Corp., Punch Div'n, N. Tonawanda, N. Y., or — **Circle Inform-A-Gram No. B55.**

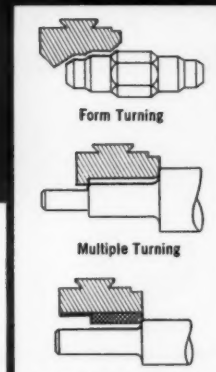
The Morton Line of Machines for Automatic Welding is highlighted in Bulletin 55 issued by Morton Mfg. Co., Broadway and Hoyt, Muskegon Heights, Mich. Illustrated and described are contour, seam, and girth welders; and machines for special applications. Also pictured are two complete line installations. **Circle Inform-A-Gram No. B56.**

Straight Shank Twist Drills and Drill Blanks as small as 0.006" dia are featured in the 1956 catalog from Precision Twist Drill & Machine Co., Dept. 206, Crystal Lake, Ill. Included is information on HSS and carbon aircraft extension drills, fractional size drills, millimeter drills, pivot drills, taper length drills, wire gauge drills, drill and blank sets, etc. Ask for Catalog "A". **Circle Inform-A-Gram No. B57.**

Metallurgical Microscopes are included in the Unitron Microscope Catalog from United Scientific Co., 204-6 Milk St., Boston 9. These low cost microscopes are used as measuring devices and as a means of identifying the composition and structure of materials in addition to magnifying images. **Circle Inform-A-Gram No. B58.**

Die Head
HOLLOW MILLING





Carbide chasers in J & L Die Heads have reduced hollow milling time still another 80% over H.S.S. chasers, while holding surfaces to 10 RMS.

In most cases, hollow milling chasers in J & L Die Heads will do plain turning, multiple turning and contour forming four times faster than any single point tooling method. (Each of the four chasers in the set does the work of a single point tool.)

Important!

Money-saving hollow milling chasers are held in the same J & L Die Heads that guarantee Class III threads — every time.

write for folder #5433

JONES & LAMSON

Class III Guaranteed Not Sometimes, but Everytime!

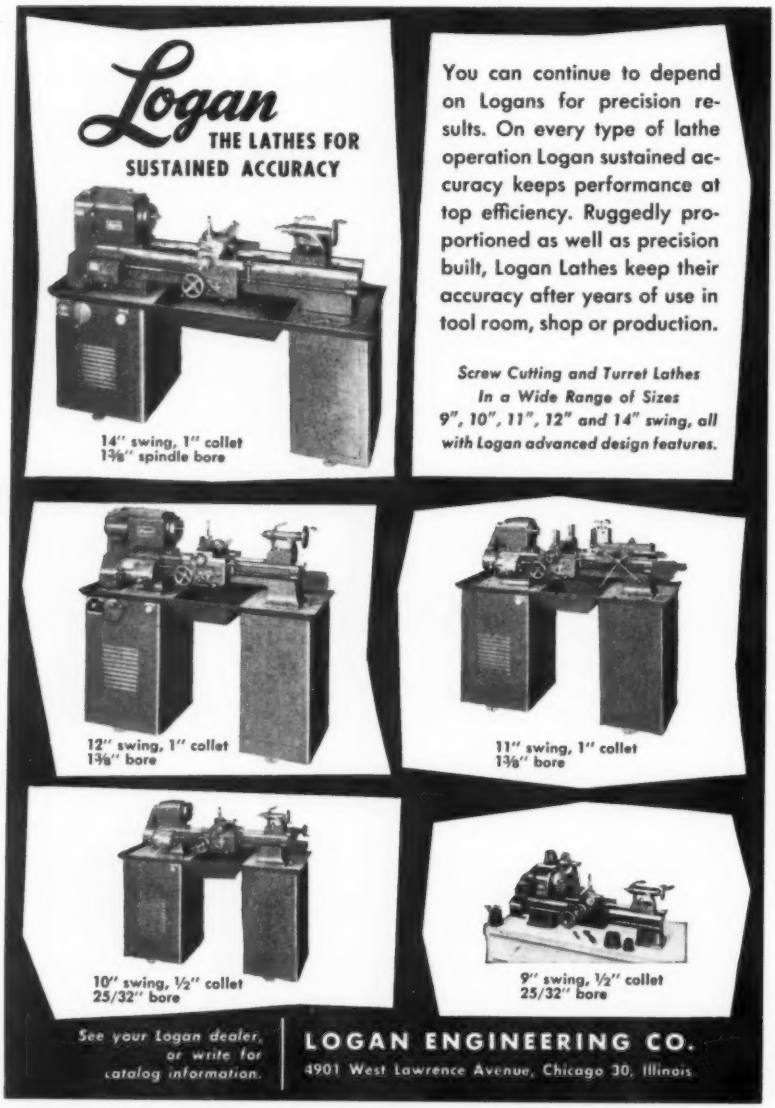
THREAD TOOL DIV.

JONES & LAMSON MACHINE COMPANY, 519 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

CIRCLE INFORM-A-GRAM KEY NO. 149

There's No Distortion and no displacement of metal with Electromark electrochemical etcher. The unit is used for production or inspection marking of carbides, gears, bearings, saws, taps, gages, chucks, tools, etc. All marks are permanent and can't be washed, dissolved or rubbed off without removing part of the surface. A bulletin containing operating instructions, general information, and a guide for the selection of Electromark electrolytes is provided by The Electromark Corp., 2093 E. 19th St., Cleveland, or —
Circle Inform-A-Gram No. B59.

Newly Designed Automatic Threading and Chucking Machines are described in a catalog published by James Coulter Machine Co., 650 Railroad Ave., Bridgeport 5, Conn. The catalog pictures and gives the advantages of the "H1" hob threading machine, the "L1" automatic threading lathe, the "Threadmaster" thread milling machine, and the "T5" single spindle chucking machine. On the back page are shown the unlimited diversification of tooling arrangements possible with these machines.
Circle Inform-A-Gram No. B60.


Logan
THE LATHES FOR SUSTAINED ACCURACY
14" swing, 1" collet 1⅜" spindle bore
You can continue to depend on Logans for precision results. On every type of lathe operation Logan sustained accuracy keeps performance at top efficiency. Ruggedly proportioned as well as precision built, Logan Lathes keep their accuracy after years of use in tool room, shop or production.
Screw Cutting and Turret Lathes In a Wide Range of Sizes 9", 10", 11", 12" and 14" swing, all with Logan advanced design features.
12" swing, 1" collet 1⅜" bore
11" swing, 1" collet 1⅜" bore
10" swing, ½" collet 25/32" bore
9" swing, ½" collet 25/32" bore
See your Logan dealer, or write for catalog information.
LOGAN ENGINEERING CO.
4901 West Lawrence Avenue, Chicago 30, Illinois
CIRCLE INFORM-A-GRAM KEY NO. 150

Soundzorber, a wire-reinforced rubber pipe for eliminating noise and vibration from waterlines, is described in a T. R. Finn catalog. Included are typical installations; noise, vibration, and water hammer control; dimensions; and comparison of acoustical impedance. Copies of Catalog SZ-55 can be had by writing to T. R. Finn & Co., Inc., Industrial Div'n, 200 Central Ave., Hawthorne, N. J., or —
Circle Inform-A-Gram No. B61.

Dimensions, Specifications, Pressures, and applications of solenoid valves in bronze and stainless steel are listed in Catalog 200 from Atkomatic Valve Co., Inc., 545 W. Abbott St., Indianapolis. The catalog covers the company's complete line of electrically operated 2-way solenoid valves for air, gas, steam, and liquid flow control. Also included are numerous coil and flow charts.
Circle Inform-A-Gram No. B62.

17 Standard Sizes and Thickness of photosensitive aluminum plates are listed in a condensed catalog. In addition, the catalog details photographic chemicals and 3 trial kits designed so that the initial user can do research work with the product prior to a complete order. Copies can be obtained from Metalphoto Corp., 6811 Superior Ave., Cleveland 3, or — **Circle No. B63.**

Avoid Multiple Setups when machining more than one surface of a workpiece with the Air-Lift rotary table. By turning a valve at the base of the platen, air is forced into the unit, raising the table approximately 0.001". The table is available with round or square platens. Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., will provide copies of Bulletin A-21, or —
Circle Inform-A-Gram No. B64.

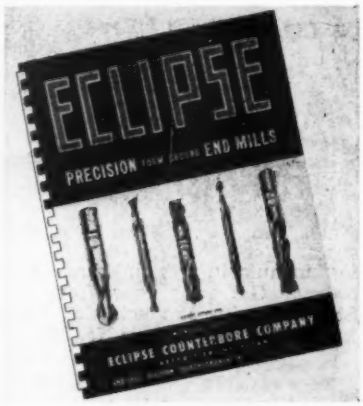
Radially-Tipped Saws cut faster, cleaner, and require a minimum of re-sharpenings. These saws are designed to avoid vibrations at any speed with permanently brazed, extremely tough, durable, and wear-resistant carbide tips. The saws are discussed in a brochure from Radial Cutter Mfg. Corp., 831 Bond St., Elizabeth 4, N. J., or —
Circle Inform-A-Gram No. B65.

Fast, Flexible, Personal Control of Illumination at the working zone is provided by Dazor floating lamps. They're used to supplement the general lighting system for machining, assembling, inspecting, and drafting. Read all about the lamps in Form 809 released by Dazor Mfg. Corp., 4481-87 Duncan Ave., St. Louis 10, Mo., or —
Circle Inform-A-Gram No. B66.

Accuracy Within 0.00005" is possible with a new taper hole gage. This gage is designed to eliminate many problems connected with checking tapered holes. The correct taper, as well as the out of round condition, can be checked while the workpiece is still on the grinder. Further details on the taper hole gage are in a circular provided by AA Gage Co., 350 Fair St., Detroit 20, or — **Circle No. B67.**

Miniaturized Electric Eyes have been designed to meet the wide range of measuring and monitoring requirements of industry. These units will fit into small impossible places and are used in counting, positioning, registration, and density. They incorporate either trigger or measuring circuits. Bulletin 552 from Ess Instrument Co., 96 S. Washington Ave., Bergenfield, N. J., contains all the details on the units.
Circle Inform-A-Gram No. B68.

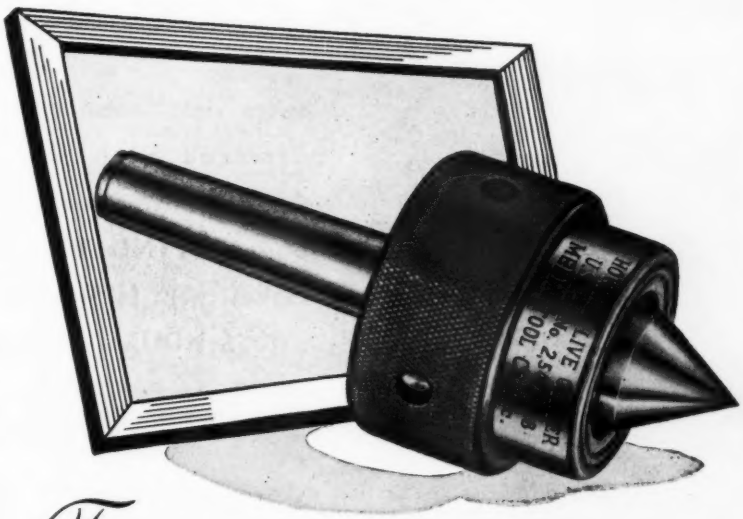
Precision Form Ground End Mills are featured in this catalog from Eclipse Counterbore Co., Detroit 20. Each type of end mill is pictured with ordering information and specifications. Also included are recommended and conventional end mill sharpening instructions. In addition, general hints on end mill operation and a table of end mill speeds are given. **Circle No. B69.**



Save Oiling Time with "Lub-O-Jet," a centrally located, self-contained oiling system that delivers oil under pressure to various points of all types of equipment. A small amount of oil is fed to all bearings simultaneously each time the pump is stroked. With the "Lub-O-Jet," production doesn't need to be stopped for periodical hand oiling. For further details, get Bulletin 36 from Trico Fuse Mfg. Co., 2948 N. 5th St., Milwaukee 12, or —
Circle Inform-A-Gram No. B70.

A New Line of multiple point enclosed presses is described in a 32-page Bliss catalog. Six basic types of presses from 200 to 2500 tons are covered, complete with specifications and dimensions. These presses are designed to meet the requirements of automated production lines. Among the features discussed are automatic lubrication systems, integral gear and eccentric units, motorized slide and blankholders, etc. Copies of Catalog 11B can be obtained from E. W. Bliss Co., Canton, O., or —
Circle Inform-A-Gram No. B71.

How to Supplement Machine Tools with Power Tools is explained in an 8-page booklet. Ten reasons are given why the strategic use of power tools in a supplementary capacity can increase production, improve product quality, and reduce costs. Illustrated are 8 case histories showing results of the use of Delta power tools. The booklet, "Make Up Your Own Mind about Using Power Tools Teamed with Machine Tools," can be obtained from Delta Power Tool Div'n, Rockwell Mfg. Co., 450 N. Lexington Ave., Pittsburgh 8, or —
Circle Inform-A-Gram No. B72.



Finest **LIVE CENTER MADE**

. . . HERE'S WHY

★ **BACK UP RING** assures positive rigidity.
★ Bar Expansion Eliminated by means of Thrust Spring.
★ Special alloy tool steel spindles, hardened and ground.
★ Matched precision ball bearings, mounted in tandem.
★ Oil impregnated bronze tail bearing.
★ Points pre-loaded and ground after assembly.
★ A distinctive oil seal in front of bearings protects them from all foreign matter. Chips, dirt and cutting oil cannot reach the bearings.

The HOWARD Live Center is the *ONLY* center that offers the patented *BACK UP RING*. The Ring maintains solid contact between the quill and head of the center . . . thus greatly increases over-all rigidity.

Send for the new MELIN TOOL Catalog No. 54-C . . . it lists, in addition to specifications and prices on the HOWARD Live Center, the complete MELIN TOOL End Mill Line.

MELIN TOOL CO. INC.

MELIN TOOL COMPANY, INC.
3371 West 140th St.
Cleveland 11, Ohio

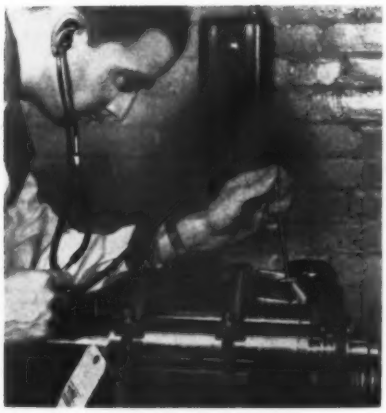
CIRCLE INFORM-A-GRAM KEY NO. 151

A Micro-Smooth Rolled Surface Finish is possible with the Faessler roller-burnishing tool. This tool will roll a burnished finish into any internal cylindrical metal or alloy surface. Further details on the roller-burnishing tool are given in Form S-100 from Madison-Faessler Tool Co., Moberly, Mo., or —
Circle Inform-A-Gram No. B73.

New T-J "Spacemaker" Cylinders are highlighted in Bulletin SM-155-3 from Tomkins-Johnson Co., Jackson, Mich. Given are mounting dimensions and specifications on 8 standard styles in 1" to 3" bores and 7 styles in 4" to 8" bores. New-type cushions result in a complete shut-off of air or oil, and assure smooth cushioning with automatic valve action for fast return stroke.
Circle Inform-A-Gram No. B74.

Star Dust Diamond Wheels and Hones are covered in a catalog from Ace Abrasive Laboratories, 35 Roselle St., Mineola, N. Y. A comprehensive assortment of wheels and hones in standard sizes is listed under each standard type. Also included is a standard marking system chart for diamond wheels.
Circle Inform-A-Gram No. B75.

Bearings, Inc. • •



takes sick, worn out or damaged High Speed Grinder and Precision Boring SPINDLES and makes them NEW again . . . in HOURS . . . not weeks

Above is our Spindle Repair "doctor" checking the "heartbeat" of a rebuilt spindle with a stethoscope. He's listening for sounds of rubbing seals or any uneven tone at various speeds that might spell bearing trouble in the making.

This is an example of the care we regularly use to make certain the spindles we rebuild are returned to normal accuracy at all speeds.

Our air conditioned repair center, trained mechanics and the immediate availability of the bearings required by all types of spindles or quills, allows us to promise faster service and guaranteed satisfaction on all work we undertake.

Bearings, Inc.

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Branches in OHIO • INDIANA • PENNSYLVANIA
WEST VIRGINIA • NEW JERSEY • KENTUCKY

Gentlemen:

Please send me complete information on your spindle repair and rebuilding service.

Name_____

Firm_____

Address_____

City_____ Zone_____ State_____

CIRCLE INFORM-A-GRAM KEY NO. 152

Maximum Precision and Versatility are features of the Hendey 9" x 24" tool and gagemakers' lathe. It has spindle speeds to 3000 rpm, 66 thread cutting and feed changes, and a feed shaft independent of the lead screw. The specifications and a detailed illustrated discussion of the lathe's standard features and equipment are presented in Form 7176 from Barber-Colman Co., Hendey Machine Div'n, Rockford, Ill., or —
Circle Inform-A-Gram No. B76.

Tracer-Controlled Lathe Operation for turning, boring, and facing is provided by the 45° Copymatic lathe. This lathe is especially suited for turning contours involving diameters or bores connected to faces by curves. Additional information is found in Bulletin 310 from The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, or —
Circle Inform-A-Gram No. B77.

"Electronic Formulation" explains the system that uses electronic computation to control the formulation of grinding wheels. The system affords greater accuracy in engineering, manufacturing, and duplicating orders. Get your copy from Bay State Abrasive Products Co., Westboro, Mass., or — **Circle No. B78.**

Taps Ground from the Solid are the subject of Section A of Master Catalog from Jarvis Corp., Middletown, Conn. Each tap is illustrated and described complete with technical data. Also given are tips on choosing the correct tap for the job and tables showing pitch diameter limits for internal threads and tap pitch diameter tolerances. In addition, there are conversion tables for numbered and fractional sizes.
Circle Inform-A-Gram No. B79.

A Complete Line of carbide tools is presented in comprehensive Catalog 56 from Super Tool Co., 21650 Hoover Rd., Detroit 13. Specifications, prices, and data are given for carbide milling cutters, end mills, reamers, drills, and eject tools; and standard single point carbide tools. Each type of tool is covered in a separate section.
Circle Inform-A-Gram No. B80.

For Arbor Spacers and Shims, Feeler Stock or Shim Stock . . .

specify top-quality

DE-STA-CO

ARBOR SPACERS AND SHIMS • 20 arbor sizes ⅜" to 4" . . . 19 thicknesses .001" to .125". Specify with or without keyways. Also available—hardened and ground spacing collars (with standard keyway) ½" to 3" long in all popular sizes. (For use in milling, slitting and gang-saw setups, shimming gears and bearings).

FEELER STOCK • Made from tempered stock, rolled to close tolerances. ½" x 25' coils packaged in transparent plastic boxes, except above .020". Strips ½" x 12", in cellophane. 27 thicknesses. All thicknesses from .001" to .032". (For use in precision fitting, checking clearances, inspection and production work.)

SHIM STOCK • Selected from material rolled to precision limits, free from burrs, and protected by oil coating. Coils packed in carton for easy dispensing and protection. 15 thicknesses .001" to .032". Sheets 6" x 12"; coils 6" x 120". Available also in assortment package of 12 thicknesses .001" to .015".

DE-STA-CO

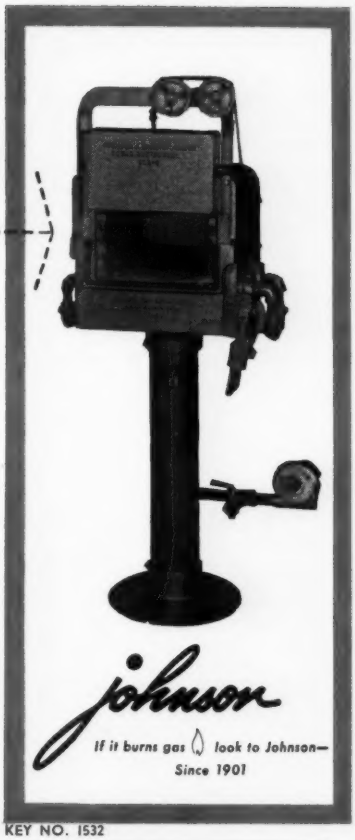
For details and prices, write for descriptive literature.

DETROIT STAMPING CO.

344 Midland Ave. • Detroit 3, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 1531

HEATS FAST SAVES TIME



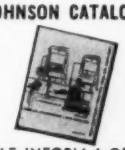
johnson

NO. 142 HEAT TREATING FURNACE

Start heat treating high speed and carbon steels while other furnaces warm up. Powerful burners in this efficient furnace get heat up to 1300°-2350° F. range in minutes. Temperatures accurately and quickly regulated. Ratchet-operated door opens upward — no need to open fully every time. High temperature refractory-lined firebox keeps heat uniform — 7" by 13" by 16½". 200,000 BTU's per hr. Carbofrax hearth, G.E. Motor and Johnson Blower included ..... F.O.B. Factory, $337.00

WRITE TODAY FOR FREE JOHNSON CATALOG

Johnson Gas Appliance Company
575 E. Avenue N.W.,
Cedar Rapids, Iowa



johnson

If it burns gas look to Johnson— Since 1901

CIRCLE INFORM-A-GRAM KEY NO. 1532

SYNTRON

Vibrating

LAPPING POLISHING MACHINES

- Automatic, high-speed lapping and polishing of parts, samples, etc.
- Produce perfect scratch-free finishes in one-third the time.
- Eliminate use of expensive polishing wheels—practically no rejects.

New Syntron Lapping-Polishing Machines are completely automatic. Driven by variable controlled electromagnets, they assure a positive, even polishing action on practically any part or sample where microscopic finishes are required. No expensive installation or grinding equipment required.

Write for Catalog Data—

SYNTRON COMPANY

341 LEXINGTON AVENUE HOMER CITY, PENNA.

CIRCLE INFORM-A-GRAM KEY NO. 1533

MEN YOU SHOULD KNOW

Jones & Lamson Machine Co. has announced the appointment of **Dr. Miles V. Hayes** to its staff for long range development studies. Before joining J & L, he was head of United Aircraft's helicopter section, research department. **John E. Barbier** will fill the newly created post of manager of engineering to coordinate all engineering activities of the company. **W. F. Couts** will take over as manager of the Thread Tool Division.

The new president and general manager of Baker Brothers, Inc. is **Roland Lehr.** Prior to joining the company, he had served as sales manager of Quincy Compressor Co. for 15 years.

◆

George W. Blackmore has been named general manager of the Materials Handling Division of Heppenstall Co. Until recently, he was owner of Automatic Gas Equipment Co., which he established in 1922.

For...

General-Purpose Sawing

with

High Speed

Accuracy, Economy

Model 4B/M2/E2
Equipped with standard work track
(Optional Equipment).

Let us prove to you the many reasons why this MARVEL Hack Saw offers the cheapest, most accurate and fastest "cut-off" method available to you at a low initial cost.

Ask your dealer, or write us for Bulletin GP35 which fully describes and illustrates the many exclusive features which makes this Hack Saw Machine your "best buy".

MARVEL No. 4B

HIGH SPEED HACK SAW

Exclusive features

1. Horizontal Ball Bearing Saw Frame.
2. Screw Feed—Automatic or Hand Driven.
3. Quick Return Stroke—allows greater number of strokes per minute.
4. Simple Positive Coolant System.
5. Adjustable Stroke—can be shortened for larger capacity.
6. Speed Range—available in 1, 2 or 4 speed models for wider range of work.

MARVEL Metal Cutting SAWS

Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 Bloomingdale Avenue • CHICAGO 39, ILL.

CIRCLE INFORM-A-GRAM KEY NO. 154

Six changes in plant personnel have been disclosed by Chevrolet Motor Division, General Motors Corp. **James H. Allen** and **Earl A. Hall** have been assigned to the Central Office manufacturing staff. **Leonard R. Mason** will succeed Mr. Allen as manager of the St. Louis assembly plant. Mr. Mason's position as manager of the Atlanta assembly plant will be filled by **Leonard F. Coyle.** Mr. Coyle who was general superintendent of production at Atlanta will be succeeded by **Harvey L. Green. John H. Greenough** has been promoted to manager of the truck body plant in Indianapolis.

◆

O. Jules Poupitch will head the new development program for Illinois Tool Works, as product development consultant. He will serve both the Fastex Division and the Shakeproof Division. Mr. Poupitch has been associated with the company since 1933.

◆

Helmut Heuser has been added to the engineering staff of Bokum Tool Co., Inc. The announcement was made by **Fried Heuser.**

◆

George Goepfrich has become director of engineering and development for Skinner Chuck Co. The new chief engineer of the Electric Valve Division is **Robert B. Clay.**

◆

The new chief engineer for York-Gillespie Mfg. Co. is **R. G. Dragar.** He is in charge of designing all new machinery developed by the company. Mr. Dragar has had 28 years of experience in engineering.

◆

Earl C. Hughes has been elected a director of The L. S. Starrett Co. He is also vice president and secretary of Bay State Abrasive Products Co.

◆

The election of two new vice presidents of Formsprag Co. has been announced by **J. Lawrence Buell, Jr.,** president. They are **L. T. Szady,** vice president in charge of engineering; and **Charles F. Trapp,** vice president in charge of sales.

◆

Stephen L. Ingersoll has been elected president and general manager of Ingersoll Steel Division of Borg-Warner Corp. He succeeds **H. G. Ingersoll** who has retired.

◆

Richard H. Marvin will take over the position of chief engineer of the Watertown Division's hydraulic equipment section, The New York Air Brake Co. Prior to joining the division's engineering staff, he had been employed for 10 years by Franklin Institute.

MEN YOU SHOULD KNOW

William B. Shimer will take over as chief industrial engineer for De Soto Division, Chrysler Corp. In his new position, Mr. Shimer will be responsible for all supervision of the master mechanic, time study, and cost estimating departments. He joined Chrysler in 1944 as master mechanic on the B-29 program. **Vaughn E. Hayes** has been named master mechanic of the division, replacing Mr. Shimer. Mr. Hayes became associated with the division as chief tool and die designer in 1942.

◆

Jesse L. Powers is the new general manufacturing manager of Buick Motor Division. Mr. Powers, a veteran of 40 years with the company, succeeds **Edward T. Ragsdale.** The appointments of **Donald F. Taylor** as assistant general manufacturing manager, and **Joseph J. Schweinfurt** as general superintendent of all plants were also announced.

◆

The appointment of **F. B. Tannehill** as chief industrial engineer has been disclosed by Axelson Mfg. Co. He had been employed by Automatic Electric Co. as supervisor of methods engineering.

◆

John P. Bunce has become assistant works manager for manufacturing operations at Kearney & Trecker Corp. He has been with the company since 1941. The post of chief engineer of the Aircraft Machine Tool Division will be filled by **W. E. Brainard.** He has had more than 20 years experience in aircraft manufacturing and engineering.

◆

Three major promotions have been announced by Dodge Division, Chrysler Corp. **R. D. Engle** will take over as chief engineer-car operations, and **S. J. Tompkins** as chief engineer-truck operations. Mr. Engle will be assisted by **George W. Gibson** who has been named assistant chief engineer-car operations.

◆

William J. Weber has been named assistant process engineer for Kennametal Inc. In this position, he will be engaged in methods and standards activities. Mr. Weber is a former production supervisor and development engineer for AC Spark Plug Division of General Motors Corp.

◆

Harold Ruehl has been named chief engineer by Erickson Tool Co. His appointment fills the position left open by the death of **Robert F. Jacobs.** Before joining the company, Mr. Ruehl was associated with Industrial Power Division of International Harvester Co., as chief tool engineer.

Philip O. Waggoner has been promoted to the post of plant manager at the Capehart plant of Capehart-Farnsworth Co., replacing **James B. Mosier.** He formerly was with the F. L. Jacobs Co.

◆

Herbert I. Segal, a director of Van Norman Industries, Inc., has been elected president of the company. Mr. Segal has been engaged in the machinery business or related fields since 1914.

Richard E. Whinrey has been elected a vice president of Link-Belt Co. He has been with the company since 1925.

◆

Amchem Corp. has been formed with **A. J. Zaehringer** as president. Mr. Zaehringer was formerly with Thiokol Chemical Corp. The new company has taken over the production facilities of Amchem Co. and offers an expanded line of epoxy resin formulations.

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CIRCLE INFORM-A-GRAM KEY NO. 155

Loewy-Hydropress, division of Baldwin-Lima-Hamilton Corp., has announced the appointment of **Carl Haugh** as district sales manager, rolling mill equipment. He will make his headquarters at the company's Pittsburgh offices.

Edward J. Novack has been appointed special representative to machine tool builders for Kennametal Inc. He has had 14 years experience in the metalworking field and joined the firm in 1950.

◆

Thomas W. Carroll has taken over as sales manager for the Dumore Co.

◆

Earl R. Dew will serve as a sales representative for Clearing Machine Corp. in the company's Toledo, Ohio territory.

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CIRCLE INFORM-A-GRAM KEY NO. 156

Splitting of the present Chicago sales territory into three independent districts has been announced by The Warner & Swasey Co. **Charles Magill** is the district manager for the Des Moines territory; **Philip A. Kennedy,** St. Louis territory; and **Craig R. Smith,** Chicago territory. **Otto R. Schubert** is serving as district manager for the Detroit area and **Virgil P. Karns** as field engineer in the same area. A field engineer for the territory served by the Dayton, Ohio, office is **Gilbert Lutz.**

◆

Jack A. Heath has been named a field engineer at the West Coast district office of Norton Co.

◆

Jack White is the new assistant sales manager for Colonial Broach & Machine Co. Before joining the company, he was a partner in Cameron and White Co., a Detroit engineering firm.

◆

Whitman & Barnes has announced several changes in personnel. **Don Anderson** is the new district manager of the New York office; **Joseph Rodecker,** sales engineer in Indianapolis; **Don Parker,** sales engineer in San Francisco; and **Harry Peche** and **John Wiers,** sales engineers working out of the Chicago district office. Two other new sales engineers are **Jerry E. Wiedemann** operating from Houston, Tex., servicing southern Texas and Louisiana; and **Barry Sedgwick** covering the Los Angeles area.

◆

Martin Laughlin is a sales representative for Warner Electric Brake & Clutch Co. He is assigned to a territory covering Vermont, Connecticut, western Massachusetts, and eastern New York.

◆

A new sales representative for Metal Carbides Corp. is **George J. Borovsky.** He will be connected with the Cleveland district sales office.

◆

The new manager of tool steel sales for Universal-Cyclops Steel Corp. is **Norman W. Calkins.** He will headquarter at Cyclops Division, Titusville, Pa.

◆

John C. McGreivey has become industrial sales manager for the New York division of Behr-Manning, division of Norton Co. He succeeds **A. F. Lehnhardt.** The appointments of **William J. Sweeney** and **Frederick D. Stevens** to fill West Coast sales supervisory positions have also been announced. Mr. Sweeney is the regional sales manager of the Pacific area and Mr. Stevens becomes industrial sales manager of the Los Angeles division.

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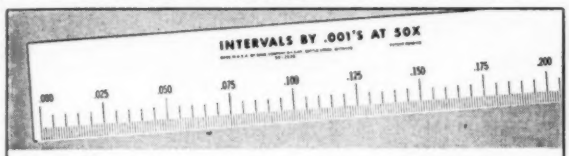

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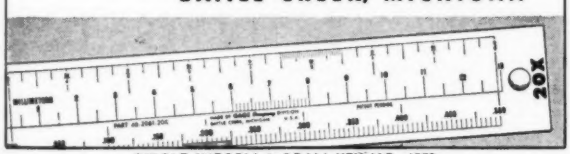
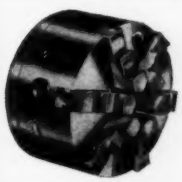


CIRCLE INFORM-A-GRAM KEY NO. 1572

compare HORTON Tru-Set FEATURES



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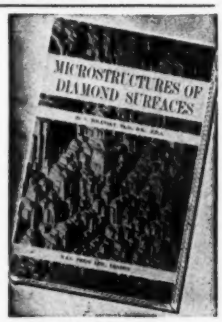
CIRCLE INFORM-A-GRAM KEY NO. 1573

MICROSTRUCTURES OF DIAMOND SURFACES

by S. TOLANSKY, Ph.D., D.Sc., F.R.S.



The remarkable pictures obtained by Professor Tolansky in his research laboratory and reproduced in this book (many of them never before published) enable fundamental new deductions to be made regarding the nature of diamond surfaces and therefore of the growth of diamond.

The text is written for the general reader and includes an elementary introduction to the optical techniques developed by Professor Tolansky that make such photographs possible. These techniques enable height or depth features as small as one twenty-five millionth of an inch to be resolved and effective magnifications in depth of half a million times to be made by simple and inexpensive means. One hundred and forty-three of these extraordinary pictures are reproduced as special plates in this book. $8.50* per copy.

CONTENTS:

The Optical Techniques
Some Characteristics of Diamond
The Topography of the Natural Octahedron Faces
The Nature of the Trigons
Some Growth Features on Octahedron Faces
Linear Discontinuities on Diamonds (Slip?)
The Etching of Diamond
Diamond Cleavage
Optical Shadow Casting
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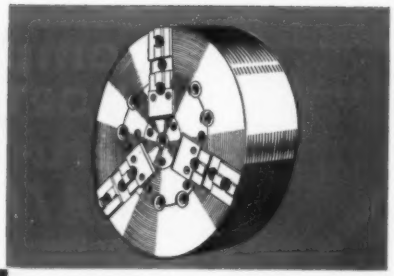

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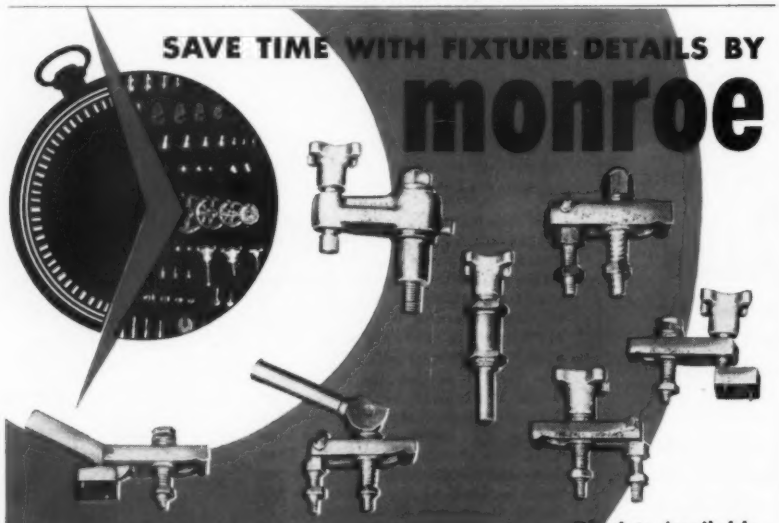

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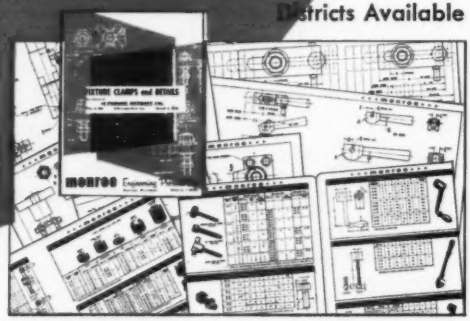

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CIRCLE INFORM-A-GRAM KEY NO. 1583

GROWING PAINS

Construction has begun on the $500,000 expansion project of **Minnesota Rubber & Gasket Company,** manufacturer of custom molded industrial rubber products. When completed in July, the addition will increase present facilities by about 32,000 sq ft, housing production area, general offices, and a laboratory and research center. This project is the firm's fourth expansion in less than three years.

◆

Marquardt Aircraft Company will modernize and expand its research and development facilities at Van Nuys with a $6,000,000 construction program. The largest expenditure will be for the Jet Laboratory, under U. S. Air Force sponsorship.

◆

The Frostrode Division of **Warren Alloy** has transferred its manufacturing machinery to new, expanded quarters in Pontiac, Mich. These quarters permit the housing of product design and development, engineering, manufacturing, and sales under one roof.

◆

Republic Foil and Metal Mills, Inc. has started to build an 8,500-sq-ft extension to the front of its present building. The addition will house new offices and additional manufacturing space needed for new equipment.

◆

A modern manufacturing plant is now being built in Logan, Ohio, for the Bonded Products Division of **The Carborundum Company.** A 4-story silo will provide storage and gravity feed for resinoid materials used in producing bonded products. The new factory will incorporate automation and a precise process air-conditioning system for high speed production of standard and special abrasive wheels.

◆

Westinghouse Electric Corporation is planning to build the world's first industry-owned nuclear materials testing reactor near Waltz Mill, Pa., instead of at Blairsville, Pa., as announced previously. The move was made to bring the reactor closer to the company's other atomic power activities. The new test reactor which will cost $6,500,000, will be used to test materials under conditions similar to a power reactor.

W. Sly Manufacturing Company is re-arranging production lines to "free" 7000 sq ft of manufacturing space. It is part of a 3-year, $500,000 modernization program.

◆

The Liquidometer Corporation will build a new Los Angeles engineering and sales office. The building will be equipped with the latest test equipment for overhauling and repairing the company's line of industrial and aircraft liquid gaging instruments.

Borg-Warner Corporation is planning to spend approximately $25,000,000 for expansion of its facilities this year. Most of the 1956 expansion funds will be allocated to three projects: the Marbon Chemical Division's new chemical plant in Washington, W. Va.; an electronics plant and laboratory being built for the Byron Jackson Division in Santa Ana, Calif.; and the Borg-Warner Research Center being erected in Des Plaines, Ill. In addition, a plant of Borg-Warner Ltd. is being constructed at Letchworth, England.

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CIRCLE INFORM-A-GRAM KEY NO. 159

A Story of In-Plant Training in S. Q. C.

by Robert M. Laforge
Associate Professor
UNIVERSITY OF TENNESSEE
Knoxville, Tennessee

IN THE YEARS WHEN Statistical Quality Control was first accepted by industry (during and immediately after World War II), the traditional training procedure was to select one or more men from a plant and send them away to a "short course" of ten days or two weeks. These men then returned to the plant and conducted training and orientation courses in addition to initiating a program of statistical quality control in the plant.

The short courses were in reality intensive presentations of the theory and application behind probability, process control charts, and acceptance sampling with emphasis on the application. They were usually presented by college or university faculty teams at times when teaching loads permitted. It must be said that this type of presentation was highly successful and a large number of plants throughout the country got started in S.Q.C. this way.

As the use of Quality Control techniques has become more widespread, the number of firms who feel need of this traditional type training has declined because (1) college-trained personnel can be more readily obtained, (2) qualified persons can be hired with actual S.Q.C. experience, and (3) the number of plants where the more obvious savings can be made has been reduced.

With the reduced demand for the traditional short course, the number of such courses being offered and their frequency has been appropriately reduced. There are still many plants that need help to get started on a S.Q.C. program. One answer is an in-plant training program which can be better and more economical than the short course procedure.

A typical case of this in-plant instruction was recently conducted by the writer at the Decatur, Alabama plant of Wolverine Tube, Division of Calumet & Hecla, Inc. The management of this progressive plant wanted to get a program going, yet they were equally concerned that it must be accepted as a part of the plant-wide scheme of things.

The traditional approach of bringing in a consultant to start the ball rolling and sending a man off to take a short intensive course in theory did not appeal to this group, and they were anxious to try some plan wherein all training could be carried on at their own plant. Accordingly, it was decided to break away from the traditional approach and find someone who could not only train their future S.Q.C. supervisor, but indoctrinate the foremen and supervisors at the same time. At this point a consultant was brought in to advise a schedule and plan for training.

A program of eight hours of instruction in four sessions was set up to orient supervisors, foremen, and representative technical personnel. These sessions covered the answer to "What is this all about?" rather than "Why does it work?" or even "How do you do it?" Practically all reference to technical nomenclature was omitted, and the whole approach was to inform rather than to instruct. Demonstrations were used to illustrate and clarify some of the concepts and purposes of the program. The over-all effect of these orientation periods was to enable the supervisory personnel to recognize this as a new tool to be integrated into the existing management plan for continuing improvement in production. This group responded with not only a surprising interest, but an expressed desire to "try it out."

In addition to the orientation program at Wolverine Tube, a promising young engineer, already familiar

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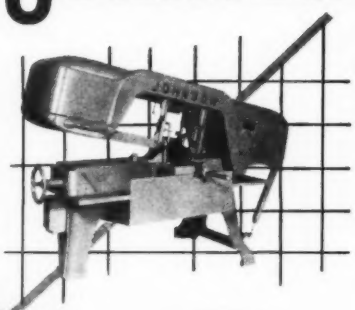

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CIRCLE INFORM-A-GRAM KEY NO. 160

with the plant operations, was designated as the supervisor of a new plant S.Q.C. program. This young man was tutored through the theory and practice usually included in an introductory S.Q.C. college course in ten sessions of eight hours (with time out for the orientation sessions previously described).

Using a standard text it was possible to cover rather thoroughly the concepts of variation and normal distribution; background and construction of control charts; simple acceptance sampling plans; and elementary probability problems in ten working days. Illustrations, examples, and practice were tied in closely with materials and problems peculiar to that particular plant.

In addition to two weeks of theory, the Wolverine quality control training program included two weeks of practice under the supervision of the consultant and follow-up visits every six weeks by the consultant. Suggestions concerning appropriate applications were discussed in various sections of the plant throughout and following each phase of training.

At Wolverine Tube the intensive training was given not only to the newly appointed Q.C. supervisor, but also the chief inspector. The orientation on the purposes and general techniques was given to 14 other supervisory personnel to help pave the way for the introduction of an S.Q.C. program in the plant. The period of instruction was two weeks, but the trainee benefited more than from a comparable "class" period, because such teaching can be more effective for the following reasons:

1. The instructor can progress as quickly as his trainee can absorb the material.
2. It is possible for the trainee to ask unlimited questions which not only keeps him abreast of the teacher, but helps develop the subject matter to match the needs of the moment.
3. It becomes a person-to-person contact which is much more conducive to transmission of ideas than the kind of contact normally experienced in a classroom group.

Certain supplementary benefits may also be derived from this kind of program, for example:

1. The instructor may be used to conduct some orientation presentations to management or to supervisory personnel.
2. More than one employee can attend tutoring if desired at no extra cost.
3. The qualified consultant can furnish advice or expert opinion in his field while in the plant.
4. By guiding the trainee in the applications of the technique to certain plant problems, the instructor actually can suggest and help initiate the first installations in the plant.
5. If guidance can be continued after the bulk of tutoring is completed, the program can be actually started with the assistance of the consultant, who can lend confidence and actual assistance in setting the program into action.
6. Because of the early orientation and the initial assistance in getting started, the program can get rolling sooner.
7. The cost of this service was not much more than what it would have cost to have sent the newly appointed Q.C. supervisor to a "short course".
8. Other benefits, of course, depend on the over-all effectiveness of the consultant, who may be able to do a much better selling job than the less experienced Q. C. supervisor.

A check-up six months later indicated that remarkable progress had been attained in the Q.C. program. Not only were control charts being used regularly, but better control was being attained at a savings in inspection cost. In other words, the new S.Q.C. section was already paying for itself.

It is unusual to find such success in as short a period as six months, but this speed is perhaps the greatest benefit of the in-plant method.

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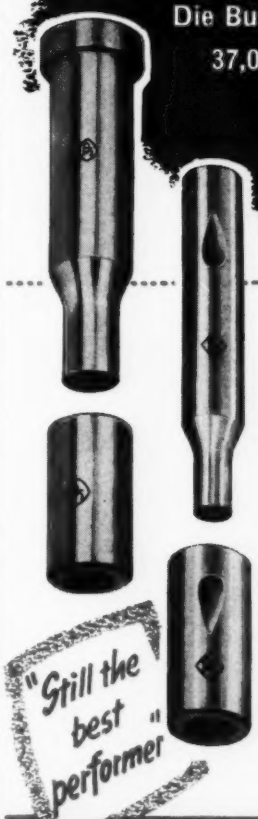

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CIRCLE INFORM-A-GRAM KEY NO. 161

A Plan For Good Plant Housekeeping

by C. P. Hawkins
Vice President
THE TRUNDLE ENGINEERING COMPANY
Cleveland, Ohio

HENRY FORD ONCE OBSERVED THAT if he acquired a business, his first effort would be to put the plant in a clean and orderly condition and see that it was maintained that way.

This thinking is reflected in the policies of all progressive modern companies. It isn't so much whether you can afford such a program, but, more pointedly, can you afford not to have one?

Companies without a well-defined good housekeeping program would do well to study their present actual housekeeping costs. When all costs are given a dollar value, it will be obvious that good housekeeping, properly planned and supported, will result in substantial savings. Cost-conscious executives realize that housekeeping practices are a definite factor in their overall cost, and apply the same as any other management control.

Good housekeeping practices should be based on degree of cleanliness desired, workloads based on time standards, degree of effectiveness possible, and cost.

These practices affect practically every variable element of cost of any producing company. Some of the benefits derived from good housekeeping are somewhat intangible, but an evaluation of all factors, plus and minus, will lead to the conclusion that it is just good business to have a well-defined and executed program.

Establishing the System

Training the people who will carry out the program is perhaps the most important step in establishing a good housekeeping program. They must realize that the program is to be a continuing effort, with definite assignment of duties and with time provided in work schedules for performing them. Owners must realize that there will be a starting cost in setting up the program, including the equipment and work to bring the plant up to the standards desired and the equipment needed to maintain those standards.

Too many such programs fail through lack of cooperation on the part of the shop people. It is costly and futile to attempt to overcome the poor work habits of all employees through the use of an additional janitor. The entire work force must be educated to maintain order in their immediate work spaces so that cleaning can be done effectively and economically. Employees should be given printed standardized instructions covering such things as:

Removal of all materials, both scrap and good, and cleaning up of the work area when a job is completed.

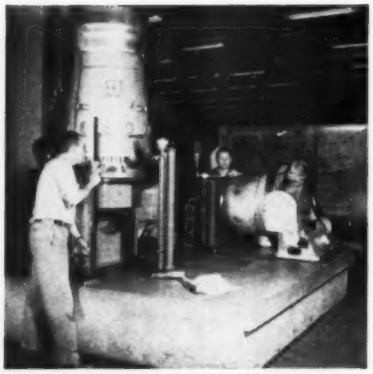
Keep work areas in order. This means nothing left on window sills or on the floor under machines and equipment; unused tools and accessories in their proper places on racks, and materials placed on skids or in racks which can be swept under.

Placing of waste or refuse in conveniently located and properly identified containers for rags, paper, and chips, to be emptied on regular schedule.

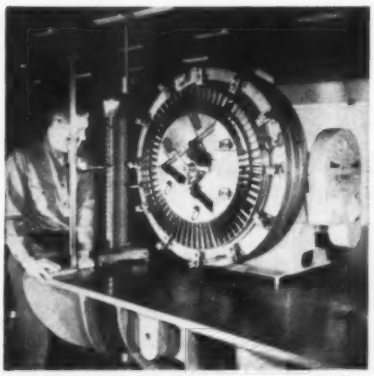
Adapted from Technical Aids for Small Manufacturers, published by the Small Business Administration.

ROTABS Beat Precision Inspection Costs...

This 24" ROTAB plus centering fixture cuts checking time for 11 dimensions on six vane segments from several hours to 5 minutes each.



Checking big jet engine assemblies is fast and simple on ROTABS (36" & 48"), eliminates costly fixtures made obsolete by engineering changes.



Seconds-of-arc precision allows quick, accurate inspection with low cost standard gages. Here 36" powered unit checks vane spacing.

For small parts inspection this 12" universal ROTAB minimizes setup and inspection time, does not require power for tilting and rotation.

For complete data on the optical precision readings you get with the ROTAB at the lowest cost, write:

MACHINE PRODUCTS CORP.
6771 East McNichols Road . Dept. G . Detroit 12, Michigan
CIRCLE INFORM-A-GRAM KEY NO. 162

Foremen and supervisors should be schooled in enforcing these standard practices. Any unsatisfactory conditions found on regular inspection should be discussed with those responsible for them.

Organization of the program should start with assigning the functions necessary to make it part of the regular operating procedure. There are two principle functions: planning and operations.

Putting the System into Operation

The president of a small, well-established firm, convinced that good housekeeping was good business decided to get his plant in order. He instructed his shop foremen to come forward with the essential facts and a plan which would provide satisfactory conditions from the standpoint or order and cleanliness. He wanted a plan that would be practical and one that the business could afford, rather than an immaculate condition which could not be maintained.

The size of the operation did not warrant the employment of a full-time janitor so the responsibility for planning and installing the program was assigned to the man in charge of safety and other allied tasks, subject to approval of the shop foremen.

As the first step in the program, the degree of cleanliness to be maintained in each area was determined. It was considered that five area groupings should suffice for this plant. The groupings, with the relative cleanliness decided upon, were:

1. Executive offices.
2. Work offices, washrooms, corridors, plant offices.
3. Powerhouse, gage laboratory, test laboratory, locker rooms, storage, packaging areas, shipping and receiving areas.
4. Production departments, maintenance shops.
5. Basements, idle equipment stores, transformer rooms, outside platforms.

Minimum acceptable standards were written for each item in these groupings. It was found that some areas were cleaned excessively while others, not regularly visited by company officials, were allowed to slide until a "cleanup drive" was occasioned. This type of cleaning is costly and ineffective.

A complete floor plan was laid out and the cleanliness to be maintained in each department or office was indicated by color code. The complete listing was made of all the items requiring cleaning, including walls, windows, floors, equipment, furniture, and others. This list was reviewed and all unnecessary items, such as pictures, stands, and so forth, were eliminated. Any racks or other equipment needed to get material high enough for open floor sweeping were ordered. An estimate of time required to bring the area up to the standard designated was also made during the survey.

A cleaning schedule was prepared which designated the items to be done daily, weekly, monthly, and quarterly. The schedule was subsequently used to determine the need for labor-saving cleaning devices.

Time standards were established for each type of cleaning, based on observations made by the staff men in charge of the project. While they were estimated standards rather than time-study standards, they proved sufficiently accurate for the purposes intended, i.e., to compile workloads and budgets.

After determination of workloads, time allowance was made for general service tasks such as removal and dumping of refuse, cleaning up the yard, and snow removal, as well as for emergencies such as spills, off-schedule cleanups, and mopups when snowing or raining. This was then compiled into a work schedule for the maintenance group.

The plan was installed step-by-step, the preparatory work being

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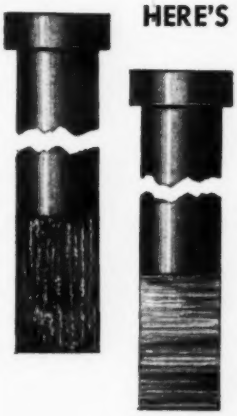

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The DURABLE combination of VERTICAL LAPPING plus ELECTROCOATING knocks out your production delays with fewer shut-downs, less die maintenance, longer uninterrupted production. Vertical Lapping and chrome electrocoating make the Durable Patent Piercing Punch the perfect answer to YOUR PERFORATING PROBLEMS.

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Write today for full details on YOUR punching problems. You'll receive a fast, practical reply from the most DEPENDABLE punch maker in the world!

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CIRCLE INFORM-A-GRAM KEY NO. 163

done under the supervision of the maintenance head. As an area was brought up to standard, it became the responsibility of the janitor. Once an area was turned over to the janitor it was scheduled for regular inspection. Inspections covered the maintenance of cleanliness and the schedule was enforced by departmental supervision.

Now that the system is in operation, any new or unnecessary procedures which might slow up the cleaning schedule are reviewed carefully. Material on the floor is questioned, and, if necessary, additional racks are erected. Conditions maintained by the employees in their work areas are examined. Adverse findings on any of these are reported to the responsible officer.

While the foregoing program may seem ambitious for a small business, it soon becomes a way of living. Once a plant is brought up to the level desired, the day-by-day effort required to maintain an orderly, clean workplace is negligible in comparison to the time and expense required for periodic cleanups.

in half the time

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make tool set-ups easy!

Now, without bushings or collets, on the first try you can set up drills, counterbores, reamers or cutters for almost any machining operation. Precision ground V-jaw vises, Brookfield Tool Holders make even toughest set-ups a cinch. With one wrench, insert the tool, tighten the jaw, then float the tool into dead center position and tighten. It's as easy as that!

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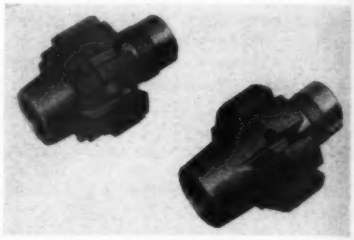
Multiple Operation Cutters Cut Job Costs

Important savings in costs of machining heavy-duty Diesel engine cylinder heads are being realized by a large manufacturer, through use of special multiple-cutting tools. Current processing has eliminated six separate operations formerly performed by single-purpose cutters. And additional savings are also effected by adapting the special tools to a standard radial drillpress already in the shop, thus making it unnecessary to build a special machine to do the job.



Inserted blade tool for semi-finish boring and cutting radius for exhaust valve seat is shown at left. At right is shown the finish chamfering cutter for the intake valve seat.

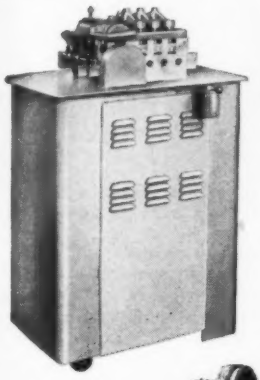
The cylinder head material is nickel cast-iron. Various initial operations are performed with standard cutters. Following this, two special Continental multiple-cutting tools designed by Continental Tool Works Division, Ex-Cell-O Corp., Detroit, Michigan, are used to machine the intake valve seat. The first tool roughs out the valve seat by boring, facing and chamfering in one pass. The second multiple-cutter finishes the valve seat and forms clearance. Openings for the exhaust valve are similarly machined with special Continental cutters. Stop collars on the tool holders control the depth of cut and all the cutters used are provided with fast, hand-detachable Continental standard drive.

Multiple cuts at one pass of the tool are also performed at two other locations in the cylinder head, the air start check valve hole and the spray valve hole. Machining of these latter openings includes rough, semi-finish, finish and chamfer operations.

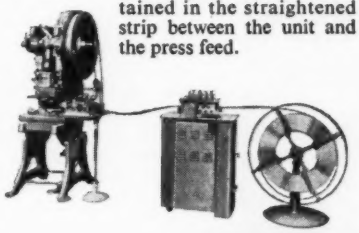
While the installation of special machines is often mandatory when production increases are desired, the same result may be possible by using multiple-cutters with standard machines, as in this instance. High output at lowered costs frequently results from such planning.

Economy • Dependability

WITTEK
STOCK STRAIGHTENERS



Used in conjunction with a reel stand and automatic feed for punch presses, the Wittek Stock Straightener is a self-contained, motor-driven unit designed for maximum efficiency in the continuous straightening of coiled stock. Standard models handle stock with widths up to 12 inches. An infinitely variable speed drive permits any desired straightening speed so that the proper slack is maintained in the straightened strip between the unit and the press feed.



This typical Wittek automatic production feeding setup includes —Wittek roll feed mounted on the punch press, Wittek stock straightener, and Wittek self-centering reel stand.

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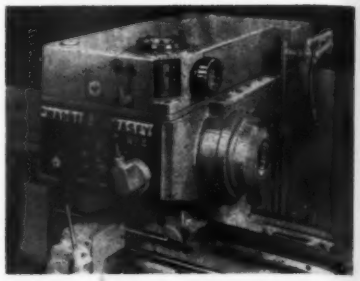
CIRCLE INFORM-A-GRAM KEY NO. 1653

NEW TURRET LATHES USE ALL-HYDRAULIC HEADSTOCKS

Simplified operating controls and faster speed changing through the use of a new all-hydraulic headstock are among important design features of two new turret lathes recently introduced.

Individually engineered for the specific range of work sizes each is capable of handling, the new Warner & Swasey No. 4 and No. 5 universal ram type turret lathes provide the balanced power and maneuverability necessary in modern high production metal turning. Both machines are fully adaptable to existing tooling and, in addition, can be used with the very latest in special turret lathe attachments.

Designed to eliminate waste motion and facilitate rapid handling, operator's controls on the new lathes are zoned, with one lever at the headstock actuating all speed changes; another lever providing forward, reverse, brake or free spindle operation. A headstock-mounted, direct-reading speed preselector, calibrated in rpm's, surface speeds, and work diameters, makes possible rapid selection and use of the proper



spindle speeds for every cut.

The new all-hydraulic headstock, which completely eliminates gear shifting by means of constant mesh helical gearing and direct-acting hydraulic clutches, provides instantaneous spindle speed changes upon the movement of the machine's single speed control lever. The hydraulic clutches require absolutely no wear adjustment, and their smooth, shockless operation insures maximum trouble-free headstock performance.

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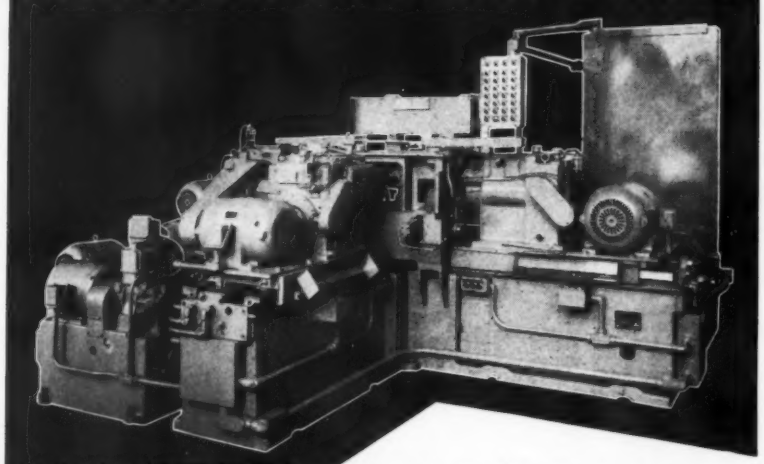

Model MR138 four-way, horizontal machine for boring, counterboring, facing, chamfering and drilling tractor main frame housings.

Use an individually designed "Hole-Hog" Machine Tool for such jobs as:

- Multi-Spindle Boring
- Single and Multi-Spindle Honing
- Straight Line Multi-Drilling
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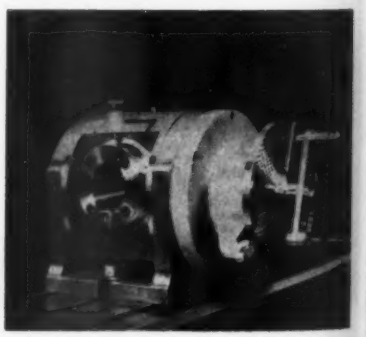
CIRCLE INFORM-A-GRAM KEY NO. 166

NEW DIVIDING HEAD DESIGNED FOR HIGH PRECISION WORK

A new precision dividing head, designed primarily for the manufacturer's universal milling machines, is accurately built for high precision work and ruggedly constructed for a variety of toolroom work such as gear cutting, cam milling, drilling, and boring.

The dividing head spindle is mounted on precision anti-friction bearings, carried in a block having 360° peripheral clamping. Spindle nose and taper hole conform to the Cincinnati Milling Machine Company's No. 50 milling machine standard. The block itself is mounted in a housing to allow 145° angular positioning of the spindle in the vertical plane.



The indexing arrangement at the side of the head consists of a crank with a retractable pin handle, sector for spacing, and reversible index plate. Rotating motion of the crank is translated through a worm to a worm wheel (40 to 1 reduction) keyed to the spindle. The worm is also mounted on precision ball bearings, and carried in a yoke which is eccentrically mounted in the block.

This construction provides a means of quickly disengaging the worm, when it is desired to employ it as a direct indexing method. For direct indexing, a small bracket, mounted on top of the dividing head, is fitted with a pin which engages holes drilled in the periphery of the spindle nose. This arrangement is desirable for setups requiring but a few indexes, such as milling hexagon bolt heads.

The dividing head is completely enclosed, protecting the working parts from dust and chips.

Complete dividing head equipment includes a tailstock with two-point adjustable center which can be swiveled 10° above or below center; steady rest; center for headstock fitted with driver and drawbolt; bracket for connecting headstock to driving mechanism. Several extra equipment items are available, including high number indexing attachment, angle plates, raising blocks, and chucks.

—— • ——

Production Tool Solves Precision Drilling Problem

Producing tiny thermocouple tubes in small ceramic insulating rods posed a tricky problem in methods engineering for Norton Co., Worcester, Mass.

In each ceramic rod are one or two holes—usually round—running parallel with the axis. Hole diameter is only 0.010", with the holes spaced 0.030" apart. Very fine wires are threaded through these holes to serve as both electrical and thermal insulators.

The insulating rods are produced by extruding an aluminum oxide mix over steel dies. Forming the tubes in the rods called for precision machining of the dies, but because contemplated production of the thermocouple tubes was limited, heavy tooling expenditures was not warranted.

Norton engineers came up with a novel procedure for locating the holes in the ceramic rods by precision drilling of the die and inserting piano wire or drill blanks to form the holes during extrusion.

The dies are drilled at 4100 rpm on a standard Delta Super-Hi Speed drill press with the work located in a small jig. A magnifying glass aids the operator in locating the holes. Tolerances are held to 0.0001". After the die is drilled to a depth of ⅛", cut-to-size piano wire or drill blank stock is inserted in the holes, with the projecting pins becoming an integral part of the extrusion die.

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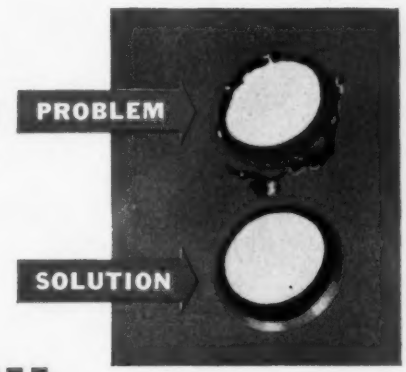
Deburr Holes the modern way...with Cogsdill BURRAWAY* TOOLS



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- Drill presses
- Motorized spindles
- Portable drill motors
- Automatic multiple spindle setups

The BurrAway's unique double-edged, retractable blade cuts clean chamfers, top and bottom, in a matter of seconds.

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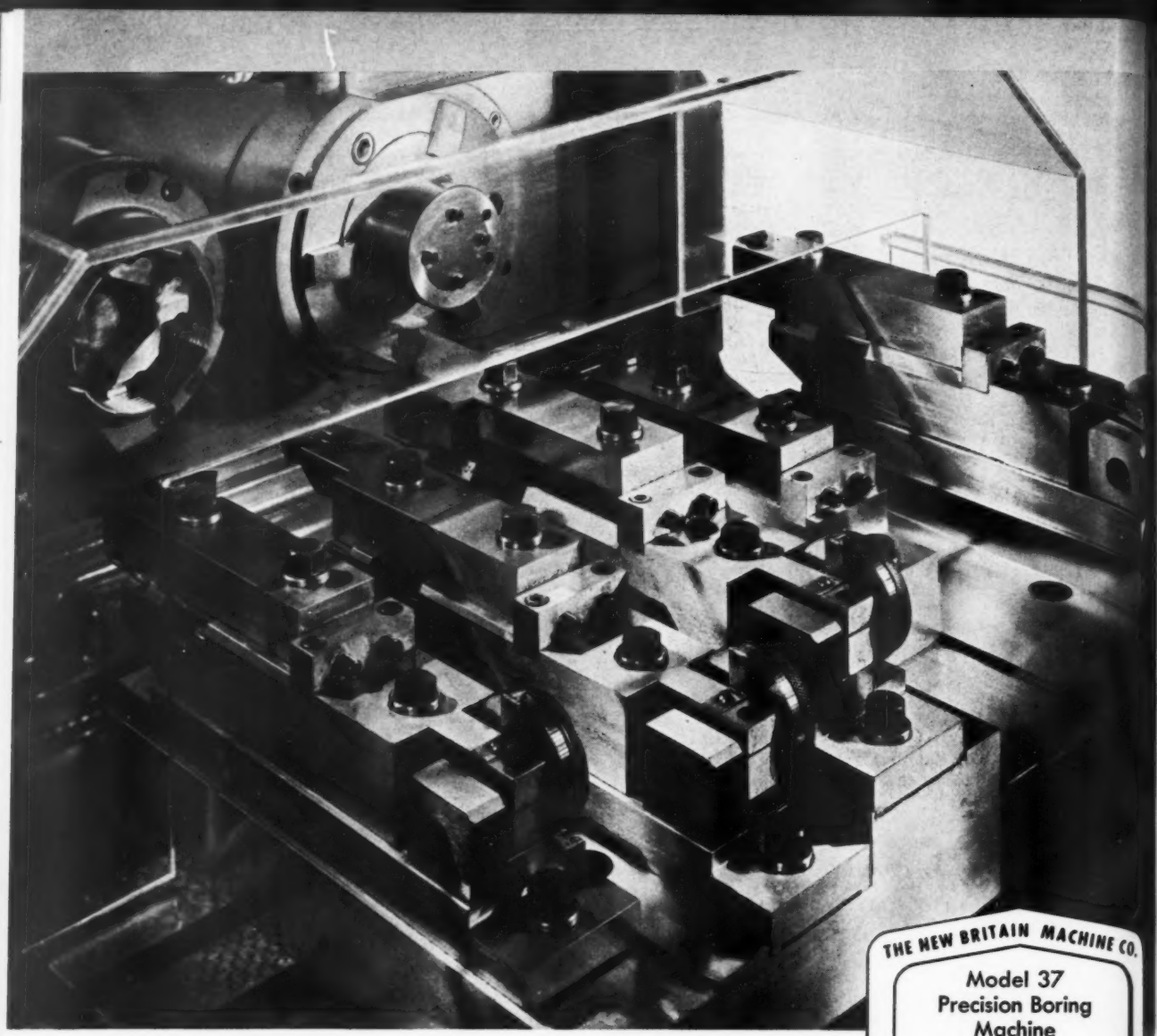

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Model 37
Precision Boring
Machine

NB

your most solid investment in precision boring machines

New Britain boring machines employ super-precision spindles and positive cam control of all tool paths. Both the spindles and the cam shaft are solidly mounted to the rugged frame to protect the original high accuracy for the life of the machine.

Available with either single or multiple spindles. Hopper feed, automatic gauging and tool resetting may be added. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

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If you do *any* turning you should investigate the New Britain **+GF+** line of copy turning lathes—whether your work calls for sustained production or short runs demanding quick setups. It turns tapers and complicated contours with the same setup used for simple O.D.'s. No need for expensive form tools. Let us demonstrate this completely different approach to turning in a color motion picture demonstration at your desk.

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Copying Lathe
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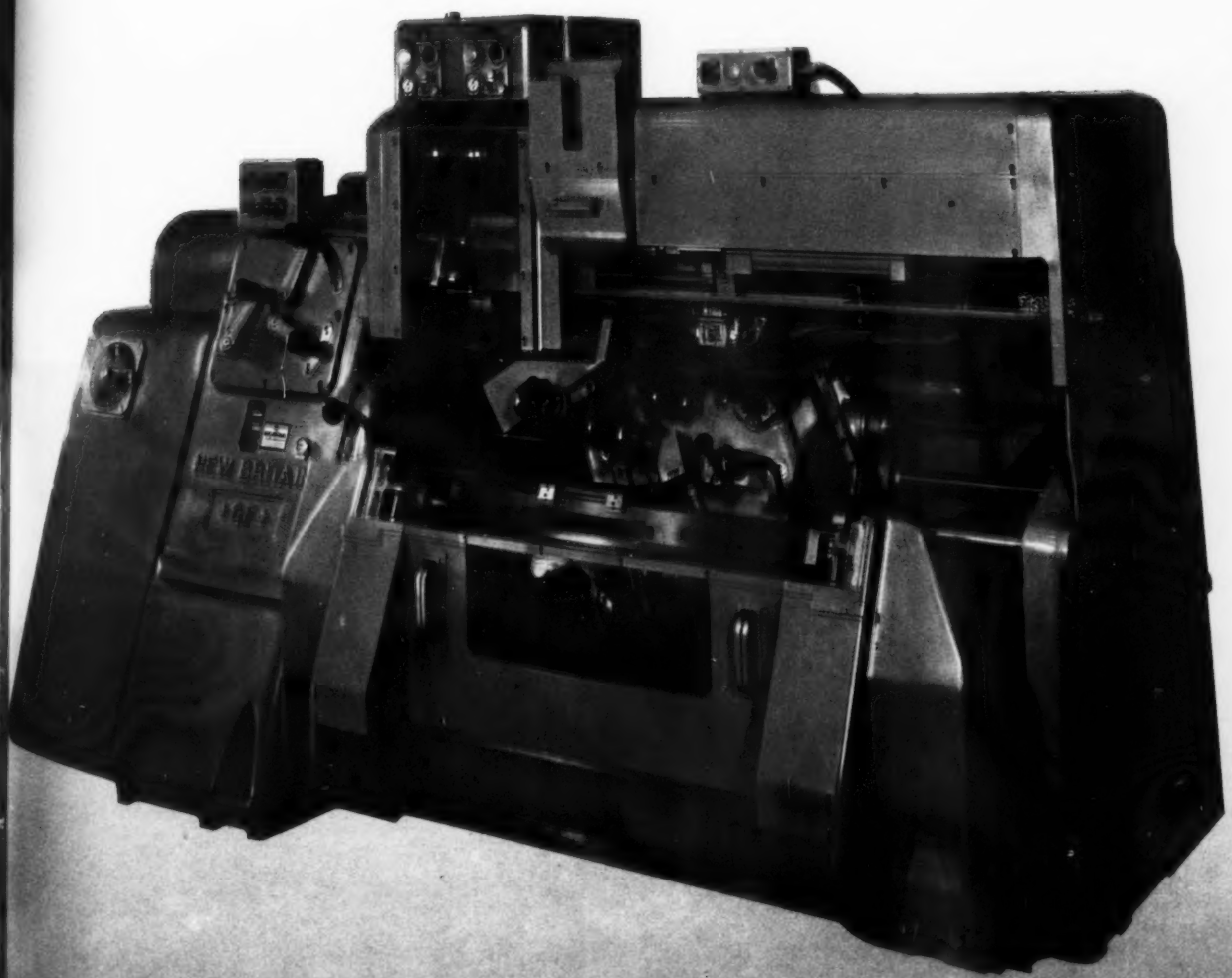
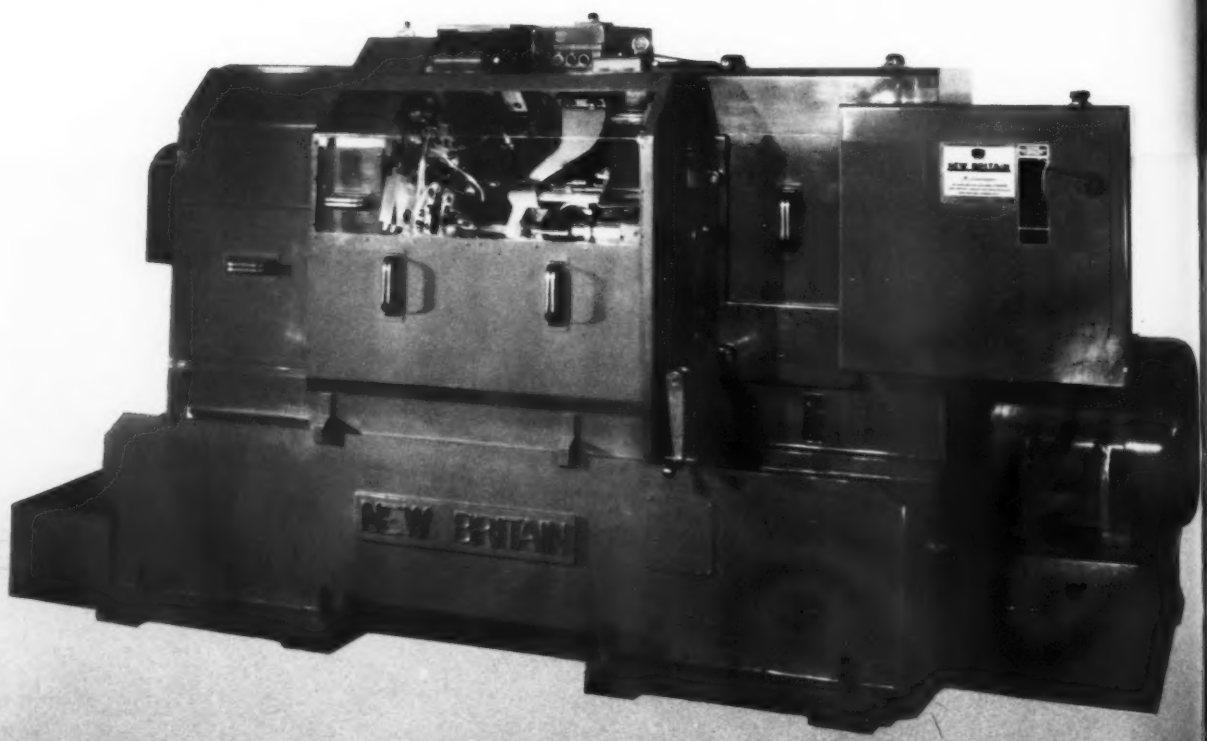
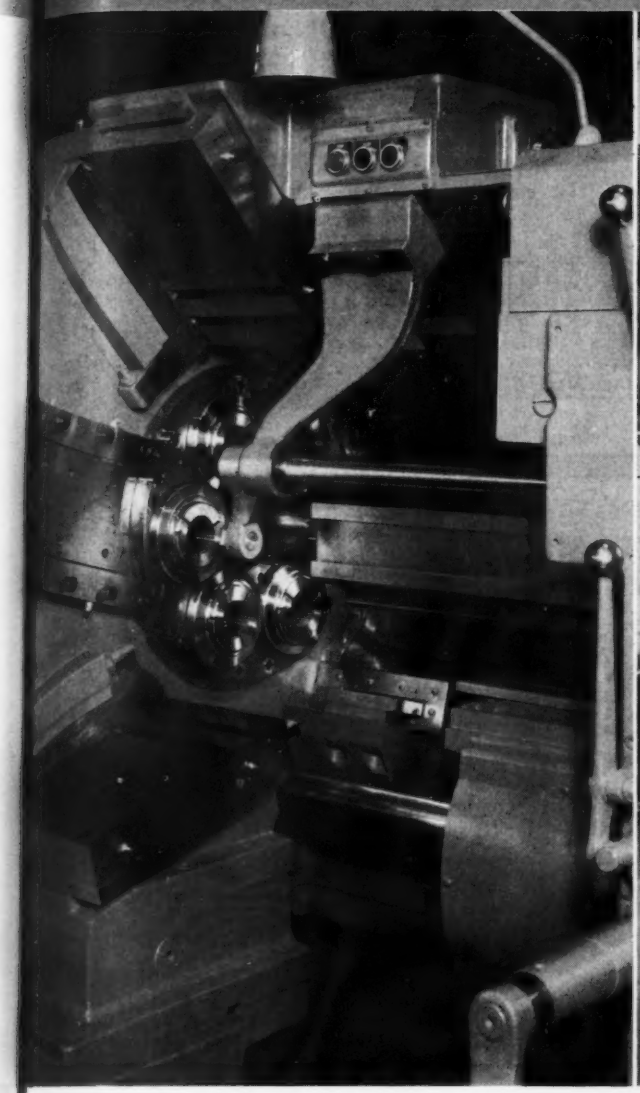


a long new step forward
in bar machine productivity

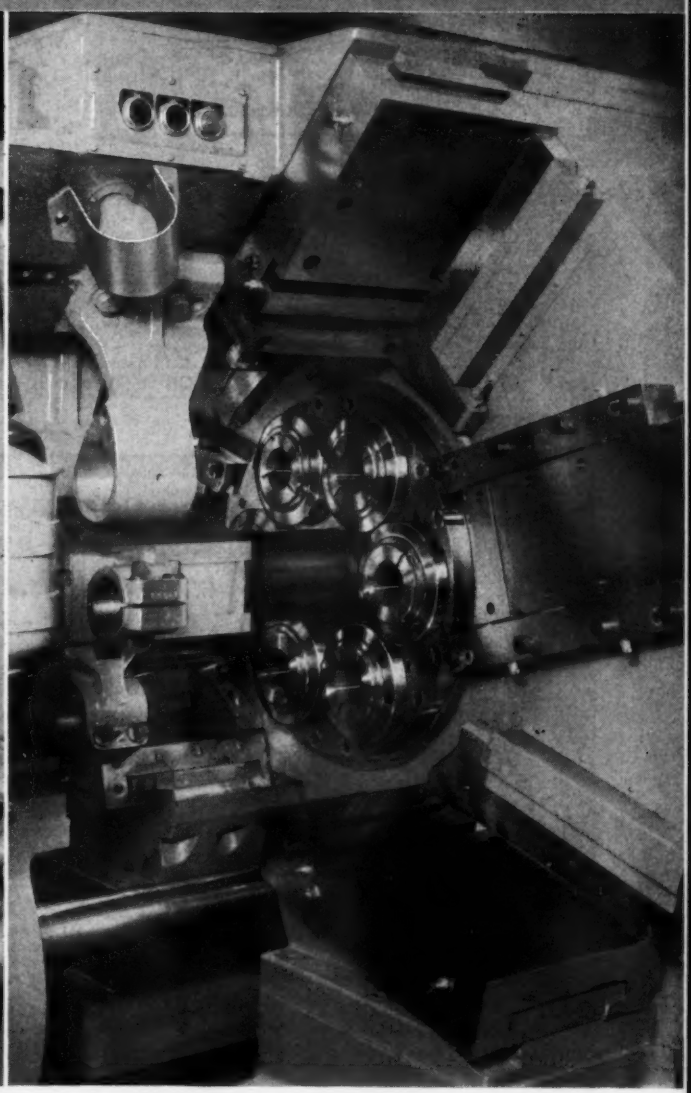
THE NEW BRITAIN MACHINE CO.
Model 62
Automatic Bar
Machine
NB

Here is a new New Britain bar machine with the ruggedness, power, speed and versatility to shed new light on your profit picture. Where you have bar work that now requires more than one machine, it may be practical to eliminate costly finishing operations by doing the whole job on a New Britain Model 62. Ask your New Britain representative or write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.





Tooling area, front of Model 62



Tooling area, back of Model 62

This new automatic combines the most important features for which New Britains are noted, with many basic improvements:

- Spindle carrier lifting to eliminate wear.
- Carrier locating and locking for uniform accuracy and rigidity.
- Spherical roller collet closing mechanism.
- Automatic stop.
- More efficient spindle spacing.
- An independent cross slide in every position.
- Maximum tool clearance.
- Improved accessibility to tooling area and cutting tools.

The NEW BRITAIN MACHINE COMPANY

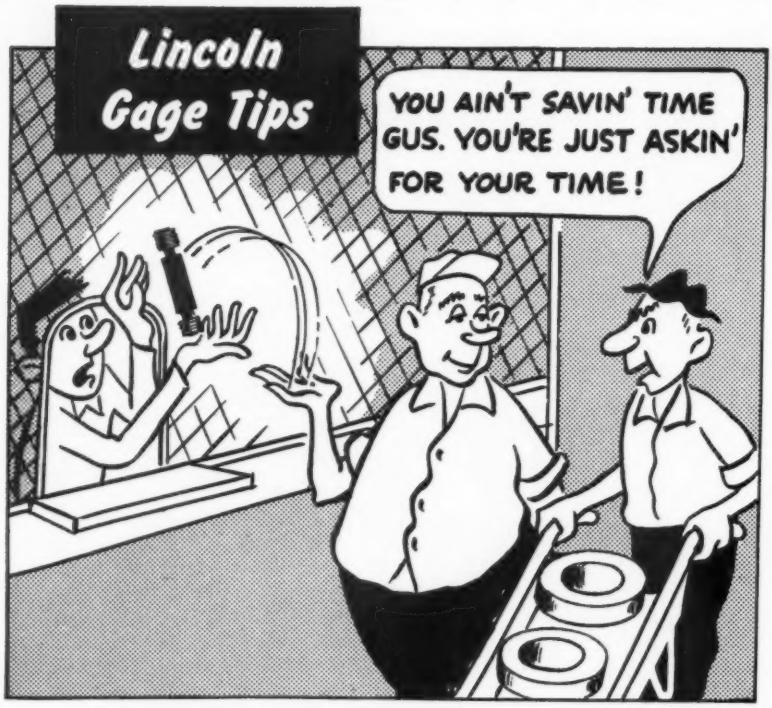
New Britain-Gridley Machine Division, New Britain, Connecticut

• *New Equipment*
• *New Materials*
• *New Literature*

WHAT'S NEW

A Vacuum Forming Machine has been designed for the lighting industry by The Auto-Vac Co., 1984 State St. Ext., Bridgeport 5, Conn. It has a maximum forming area of 50" x 50" which will produce plastic ceiling pans up to 4' square. The clamping frames are adjustable so that single, double, or four 2' x 2' pans can be formed on the same machine. **Circle No. E1.**

Nozzles for All Injection Machines are featured in an IMS catalog. Stock replacement and special purpose nozzles are included. Line drawings, illustrations, and descriptions are given for each model. Prices and specifications are also listed. Get the 1956 Nozzle Catalog from Injection Molders Supply Co., 3514 Lee Rd., Cleveland 20, or — **Circle Inform-A-Gram No. E2.**



HANDLE A THREAD GAGE WITH CARE. Try not to bang it against another hard object or drop it. Such acts could nick the thread crest thus making the gage useless.

Some gages can be repaired only by grinding them under-size then bringing them up to size by Lincaloy chrome plating.

We, at Lincoln Gage, have developed this new plating process called Lincaloy. Ordinary plating processes have never given complete satisfaction. The chrome has chipped, peeled or distorted the thread form. Lincaloy eliminates these defects. A Lincaloy gage will give up to 400% more gage life and be extremely resistant to abrasion on production parts.

SAVE THOUSANDS OF DOLLARS! The Lincaloy process is not expensive and can be used on all gages. Send in your worn out gages. They will be returned better than new, at a much lower cost!

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23902 Harper Ave., St. Clair Shores, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 172

"Tu-Bend" Dies for Bending Metal Tubing into almost any shape are now available from Warren Plastics and Engineering Co., 27500 Groesbeck Hwy., Roseville, Mich. Complex forming in multiple planes, including short radius bends, is made possible with the new "stamping" process.

The low-cost plastic dies can be used with any conventional stamping or forming press for either high or low production runs, duplicating the work of expensive special tube bending machines. Simple lever or cam-action hand presses can be used for limited quantity production or for forming prototype tube parts.

With this new die forming process, pre-cut tube lengths can be fed and unloaded by suitable automatic equipment for mass production operations. Dies designed for production rates in excess of 250 parts/hr are now in operation.

The smooth rolling action of die contours minimizes abrasion and die wear and no lubricants are needed. These dies provide a high surface finish with no marring or scratching of parts, thereby eliminating corrosion of plated or coated tubing.

Allowance for exact springback of the tube stock is incorporated in the die design to insure maximum accuracy of finished parts. The tube walls don't collapse even on short radius bends.

Depending on press sizes, multiple dies can be used for bending several parts, side by side, simultaneously. Parts produced on a multiple setup can be of the same size and shape or of different sizes and shapes. End couplings can be installed prior to bending without loss of accuracy. **Circle No. E3.**

Details on an Epoxy Resin and a Hardener have been released by Furane Plastics, Inc., 4516 Brazil St., Los Angeles. Epocast 15 is a new modified epoxy resin developed for electronic insulation applications requiring a semi-rigid, low modulus material. It will offer high electrical resistance throughout the temperature range of —65°F to at least +300°F. Adhesion to metals, etc. is excellent and cure takes place at moderate temperatures. Epocast 15 is a low-strain-inducing insulation medium that is useful for electronic potting, impregnating, and encapsulating. A hardener for epoxy resins, Promoter D-40, has also been announced. It is a mild, non-toxic, amine-type hardener having a pot-life of 24 hrs at room temperatures and with curing temperatures in the range of 140°F — 200°F. **Circle Inform-A-Gram No. E4.**

W IN PLASTICS?

• *Plastics Fabrication*
• *Plastic Tooling*
• *Plastics Molding*

A Number of Products are offered by Amchem Corp., 283 Tuxedo Ave., Highland Park 3, Mich. Series 100 epoxy-amine and Series 200 and 300 epoxy-polyamide coatings are used as protective coatings on metals, etc. They provide outstanding resistance to abrasion, weathering, chemicals, and solvents. Casting and laminating resins have been custom formulated to include potting resins for protecting electrical components, dies and mandrels for forming sheet metal parts, jigs and fixtures, etc. Series 501, 502, and 503 epoxy-polyamide adhesives and fillers dry without appreciable shrinkage and adhere to any clean, sound surface with strengths ranging up to 50,000 psi. **Circle No. E5.**

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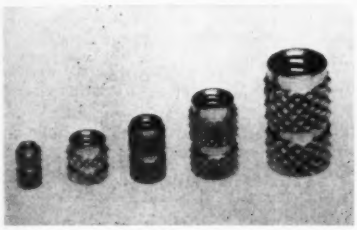

serts are available in sizes No. 2 to ⅜" in all regular thread sizes, both NC and NF. Standard material is brass but the inserts can be made to order from steel, aluminum, or stainless. For catalog sheets and further information, contact Standard Insert Co., 12270 Montague St., Pacoima, Calif., or — **Circle No. E6.**

The Packaging and Structural Plastics Markets will provide two of the largest opportunities for the plastics industry. Luria-Cournand, Inc., a plastics fabricator, sees a bright future in these areas. A 20-page booklet sketches the story of this company. The booklet shows a wide range of products produced by the firm and tells how they are made and how new techniques and bonding materials were developed for critical designs. One section covers the company's facilities for research, development, testing, prototype, and production. Copies of the booklet can be obtained from Luria-Cournand, Inc., Havre de Grace, Md., or — **Circle Inform-A-Gram No. E7.**

Plastic Tubes, Rods, and Sheets are featured in a technical bulletin issued by Cadillac Plastic Co., 15111 Second Blvd., Detroit 3. The cast acrylic rods and tubes are easy to machine and dimensionally stable. The Plexiglas sheets are shatterproof and machinable. The bulletin lists the properties and sizes of these products and gives technical data. **Circle Inform-A-Gram No. E8.**

Resilient Plastic Tooling Compounds based on combinations of Thiokol liquid polymer with epoxy resin are covered in Bulletin 124 from Thiokol Chemical Corp., 780 N. Clinton Ave., Trenton 7, N. J. General data is provided on the properties and methods of application of the compounds. The compounds are used for making shear dies, milling fixtures, etc. **Circle Inform-A-Gram No. E9.**

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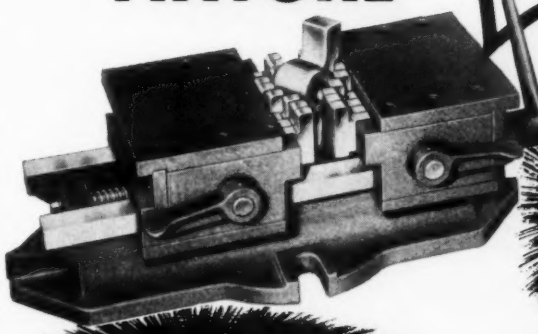

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CIRCLE INFORM-A-GRAM KEY NO. 173

CURRENT REPORT ON NON-DESTRUCTIVE TESTS OF LAMINATES

by A. J. Schwarber, Jr.
BATTELLE MEMORIAL INSTITUTE
and W. R. Graner
BUREAU OF SHIPS

FIRST INTEREST OF THE Bureau of Ships in glass-reinforced laminates centered around the use of these materials in construction of small boats. The use of these materials has extended into many other structural or semi-structural marine applications. The ever-increasing volume of the materials being procured and the structural requirements involved have necessarily increased the need for improved inspection.

Current research for the purpose of developing suitable test equipment and procedures for nondestructively testing glass-fiber-reinforced plastic laminates indicates that the ideal test instrument should have these characteristics:

1. Portability and ruggedness.
2. Economy and ease of operation.
3. Capability of detecting delamination, porosity, dry spots, resin segregations, and incomplete cures.
4. Ability to measure laminate thickness.
5. Ability to measure resin content of laminate.
6. Ability to penetrate laminate to a minimum ½" depth and to be operated from one side of the object being inspected.

Early in the research program existing testing equipment and procedures were reviewed for possible application to laminate inspection.

Inspection with Light. The most effective nondestructive tests currently in use on laminates involve visual inspection by transmitted or reflected white light.

Many tests were made with ultraviolet and infrared light to determine whether another portion of the light spectrum might prove more efficient than the white range, but white light proved to be superior. The visual inspection of laminates is effective since most serious defects cause discoloration in the material. Obviously the method is limited to translucent material, and some other means must be used where opaque laminates are concerned.

Tapping Tests. Tapping laminates with a blunt object is often an effective means for locating laminar type defects, due to the difference in sound generated when the material above a delamination is vibrated. This test method is currently used to evaluate the extent of questionable areas of laminates.

Since the results of this test method depend completely upon the skill of the inspector, instrumentation to verify his judgment would be very desirable. Experiments were performed with an electromechanical tapping device, in an attempt to develop such an instrument. The instrument uses a variable-frequency relaxation oscillator to control the tapping rate, and another control allows the force of impact of the tapper to be varied. A crystal detector is used to pick up the vibrations from the laminate. These vibrations can be listened to with earphones, and their waveform may be monitored with an oscilloscope.

The electromechanical tapper did not disclose any more information than routine tapping and listening techniques. However, a device of

Adapted from a paper, "Nondestructive Testing of Glass-Reinforced Plastic Laminates," presented by A. J. Schwarber, Jr. and W. R. Graner at the recent Technical and Management Conference of the Reinforced Plastics Division of the Society of the Plastics Industry, Inc.

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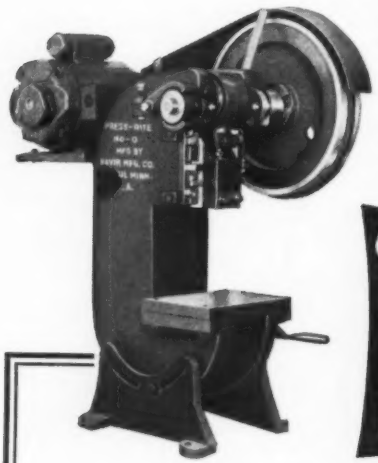

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this type may have a possible application for inspecting "honeycomb" sandwich material where bonding of the outer skin to the honeycomb reinforcement must be inspected.

Dye-Penetrant Tests. For a liquid dye penetrant inspection to be effective, defects must necessarily be open to the surface. Surface crazing and porosity, for instance, show up very well. Where penetrant can be applied to the edge of a panel, delaminations at the edge may be readily located.

Radiography Tests. Radiographs taken of a number of laminate test panels ¼" thick, made with Vibrin 112 resin reinforced with 184-114 glass cloth, clearly show areas of obvious density variations, such as gross porosity and resin concentrations. Delaminations were not detected. This method is costly and time consuming, so it has been used only for laboratory tests.

Because most reinforced plastic materials have poorer acoustic propagation qualities than metals, the use of ultrasonics to inspect reinforced laminates involves much more than a direct application problem.

Pulse Echo. A pulse echo type instrument uses a quartz crystal to transmit pulses of ultrasonic energy into the material under test. The time required for a pulse of energy to be reflected back to the crystal from an interface is measured electronically and is displayed as an indication on a cathode-ray screen. Using a calibrated screen, the thickness of a material, or the distance to a discontinuity in the material, can be determined directly. No useful results could be obtained in laboratory tests with such equipment, however.

Through Transmission. Through-transmission inspection is usually accomplished by using an instrument with two crystals, one for transmitting, the other for receiving. The crystals are mounted directly in line with each other, and the workpiece placed between them. An inspection of this type must be conducted in a suitable sound-transmitting fluid, such as water or oil, that provides acoustic coupling between the crystals and the workpiece. The receiving, or detecting crystal, produces an electrical signal proportional to the amount of ultrasonic energy impinging upon it. The signal is usually amplified and displayed on an oscilloscope screen. Since defects or discontinuities in the workpiece attenuate the beam of ultrasound, a sudden decrease in amplitude of the received signal as the workpiece is being scanned is indicative of some defect in the material.

This test method was found to be quite effective for evaluating the internal quality of small laminate test panels. Delamination type defects could readily be located in laminates up to ½" thick, the extent of the delamination area could be determined, and the panel surface could be marked accordingly. Dry-spot and gross-porosity defects also could be located.

A number of commercial resonant-frequency ultrasonic instruments were tested on various laminate samples. One of these, the Audigage, manufactured by Branson Instruments, Inc., successfully located laminations in samples ¼" thick. Thickness measurements of some laminates ⅛" to ½" thick have been made with the instrument, with accuracies within 8%. In some laminates, however, resonance indications cannot be produced.

There are other ultrasonic tests.

Audio-Frequency Tests. Early evaluation of various energy forms applicable to glass-laminate inspection indicated that dielectric tests might be developed to the point where they could furnish useful information about the material. Initial tests were performed with probes having planar contact surfaces applied to flat laminate specimens. An audio-oscillator was used to supply energy to the probes, and a vacuum-

precise dependable controls for

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TOOL ROOM
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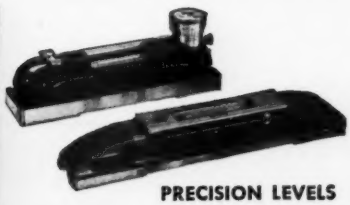

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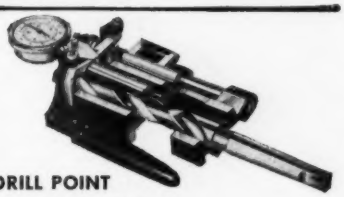

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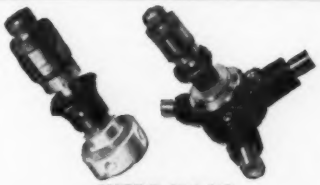
To check angle and centrality of twist drills. Available in two types; with dial indicator, for ¼" to 2½"; with screen indicator, from ⅜" to ¼".



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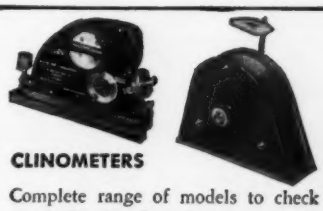

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tube voltmeter was used to measure voltage changes in the system. These early tests indicated that penetration was achieved to a depth of at least ¼" in laminate, and the method appeared feasible for laminate thickness measurement from one side of the workpiece.

Thickness Measurements. The crystal-oscillator probe used to detect variations in dielectric materials functions well as a laminate thickness gage. Applying the probe to the group of samples, it is noted that plate current shown on the indicating meter decreases as the probe is placed against thicker samples.

To see if the probe would be functional on laminates with considerable curvature, the following experiment was performed. A thickness-measurement test was made on a section of glass-reinforced plastic oil-well tubing. The 3½" O.D. tubing is made with glass-mat reinforcement and is centrifugally cast. The roller electrode was placed against the outer surface of the tubing, and readings were taken at 45° intervals around the circumference. A tubing micrometer was used to obtain actual thickness readings for correlation with the plate-current values. The maximum wall-thickness variation is about 0.025", and is readily indicated by the probe.

Another experiment with the crystal-oscillator probe involved measuring the thickness of a 26' reinforced plastic motor whale-boat hull. Six holes were cut through the hull in various locations to allow actual thickness measurements by micrometer to be taken. The probe was placed about 6" away from each of these holes, and readings of plate current taken. A calibration curve of plate current as a function of laminate thickness was obtained by applying the probe to a group of specially prepared samples made from the same material as the hull. Except for one location near hole number 3, hull thickness was measured within about 1/16". The resin content in the area of hole number 3 was considerably lower than that in the vicinity of the other holes. A more rigorous calibration procedure would probably have improved the accuracy of the measurement.

Resin-Content Measurements. Resin content as well as thickness of laminates affect the plate current readings of the crystal-oscillator probe. Although thickness appears to have the greater effect, it is possible to use the instrument as a resin-content gage.

For resin-content measurement tests, panels of the same thickness (¼") were chosen. The resin-content range covered by samples used in experiments extends from about 30 to 80%. Mat and cloth type reinforcement is used in the samples, although no sample contains both types. It was noted that the curve from the cloth-reinforced samples differs distinctly from the mat samples curve. Evidently the type of reinforcement affects the measurements.

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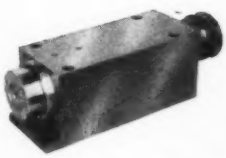

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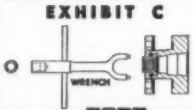

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CIRCLE INFORM-A-GRAM KEY NO. 176

Extrusion Press to be "Work Horse" at Lake Erie

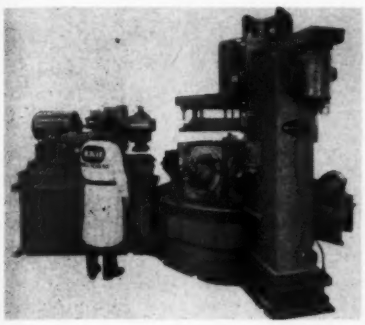
The first of a series of 2300-ton self-contained hydraulic aluminum extrusion presses has been installed by Lake Erie Engineering Corp., Buffalo, N. Y. Designed to be the new work horse of the industry, it is capable of extruding billets from 6" to 9" dia and up to 30" in length, as well as rectangular billets at speeds up to 48 ipm.

Fast approach speeds of 825 and 760 ipm make possible a non-extrusion time of less than 20 sec, the company reports. The press will handle 85% of all extrusion jobs.

Standard Parts Built into Special Machine

Building of a special, 3-way horizontal and vertical milling, drilling and tapping machine from standard components has just been completed for a leading truck manufacturer. It is to be used in machining 70-lb transmission housings at a production rate of 50 housings/hr.

Michigan Drill Head Co. of Detroit 34 built this machine, mounting a 3-position indexing fixture on a standard Michigan Drill Head 6-station, automatic index table. This indexing fixture positions the part so that all machining operations are performed in either a vertical or horizontal position rather than an angular one. Power clamping was incorporated in the fixture.



This new production machine lends itself to simple retooling for model changes because standard components are used throughout. For example, a standard horizontal way-type, self contained, hydraulic feed unit is used for milling; a standard vertical way-type hydraulic feed unit is used for drilling and reaming; and a standard quill-type master lead screw unit is used for tapping operations on this particular housing.

Production Unit Borizes 240 Parts an Hour

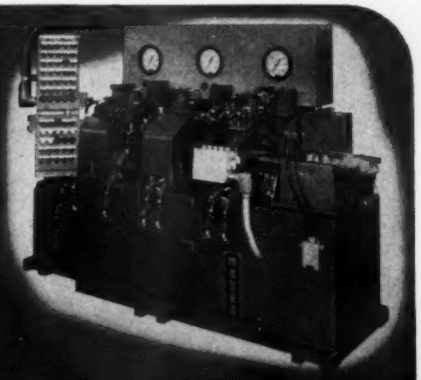
The versatility of Heald slide unit Bore-Matics is exemplified by this four station continuous production machine developed by The Heald Machine Co., Worcester 6, Mass.

With one operator, it borizes 240 refrigerator parts per hr; it turns O.D., faces rim, and chamfers 240 cast iron workpieces.

The special purpose Model S Bore-Matic has a steel weldment base designed for maximum floor space economy. Four hydraulically powered slide units are mounted on scraped base pads, each slide unit carrying two boring heads and a single motor drive arrangement. Hydraulic pressure is supplied to the slides by a 30 gal/min hydraulic power unit mounted at the rear of the machine. Rotating, air-operated, centrifugally damped workholding chucks mounted on the boring head are interchangeable to accommodate different size parts.

Tool blocks are designed so that the same tools may be used on different parts. Each of the four work stations is independently operated, two parts being machined simultaneously at each station. Air-operated fixture clamping is done by foot pedal and the cycle is controlled by pushbuttons at each station.

Production Pressure Test for AUTOMOTIVE AIRCRAFT APPLIANCE and FARM EQUIPMENT Industries

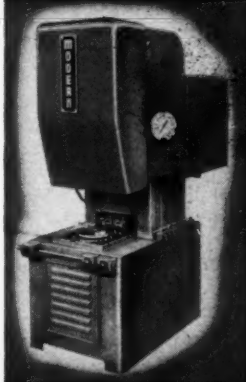


Transfer unit checks 133 manifolds per hour

Here are a few features of Modern pressure test units now in service:

- Fully automatic transfer line operation testing three separate manifold passages including marking of O.K. parts. Defectives are automatically color coded to show reason for rejection and shuttled to rework station.
- Semi-automatic checking of transmission converter and end housings including stamping of O.K. parts. Production up to 58 parts per hour.
- Semi-automatic inspection of cylinder heads including automatic "dunking" of defective parts to locate leaks.

Ask for literature describing Modern's pressure test units.



Model MPT-1 unit for transmission converter housings

MODERN®
Industrial Engineering Co.
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CIRCLE INFORM-A-GRAM KEY NO. 177

AUTOMATICALLY BALANCING HYDRA-MATIC PARTS

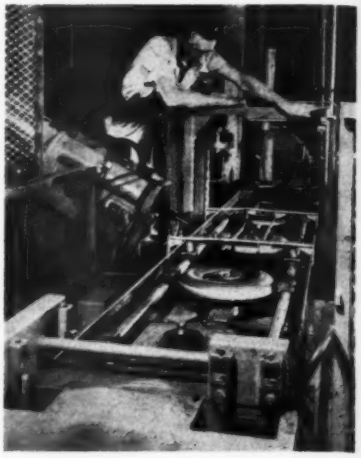
Hydra-Matic transmission parts are balanced to a higher degree of accuracy than ever before by means of electronic devices that rule out the possibility of human error.

The electronic devices are part of a new automatic balancing machine developed by General Motors Research Staff's Special Problems Department for producing 1956 Hydra-Matics at Detroit Transmission Division's Willow Run plant.

The new machine's job is to determine both amount and location of unbalance in each of the two torus units of Hydra-Matic transmissions and correct the unbalance to within a limit of ¼ ounce-inch*.

The torus assembly combines two of these units into a hydraulic coupling or fluid flywheel of the Hydra-Matic transmission. Each torus is shaped like one-half of a grapefruit, about one foot in diameter, with many vanes or buckets radiating from its center.

One torus unit is attached to the auto engine's crankshaft, while the other half facing it is connected with the Hydra-Matic transmission. When filled with transmission fluid, the torus units act as a fluid coupling to transmit power from engine to transmission.



To function properly and noiselessly, each unit must be balanced as perfectly as possible.

This precision balancing is achieved on the new GM Research Staff machine which receives the torus members on a conveyor. Each is spun at 600 rpm. If out of balance, it tends to wobble. Both amount and location of this wobble are determined automatically by the device on the balancing machine.

Formerly, the balancing was done by a machine operator who read an indicator that informed him of the amount and location or angle of unbalance.

To correct unbalance, the operator selected a certain size metal slug and welded it to the inside edge of the torus rim opposite the heavy or unbalance side. The slug compensated for the unbalance.

The electronic device on the new machine "reads" the unbalance and determines both its angle and amount. Automatically this information passes to a welding station. At this station a metal slug is measured, cut to size to compensate for the particular amount of unbalance, and welded to the inside rim of the torus.

This operation is so accurate that the metal slug is measured to sizes varying as little as .001". In other words, the slug's weight is custom tailored precisely to the amount of unbalance in each individual torus. Such precision was impossible with the earlier technique of selecting various predetermined weights of slugs.

*In measuring unbalance, engineers compute in ounce-inches. This means one ounce at a radius of one inch from the center of rotation. Centrifugal force resulting from unbalance increases as the square of speed. Thus, doubling the speed of a rotating part increases unbalance forces four times, tripling the speed increases it nine times, etc.

the cutting characteristics and life of your taps are important factors in your costs of production.

BLAKE Flute and Chamfer Grinders can make substantial savings possible in your threaded-hole costs. They do this by creating or restoring:

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The accuracy and dependability of the Blake Flute Grinder and Blake Chamfer Grinder make it possible for you to do high-efficiency tapping . . . the *only* kind which pays off in profits today!

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CIRCLE INFORM-A-GRAM KEY NO. 178

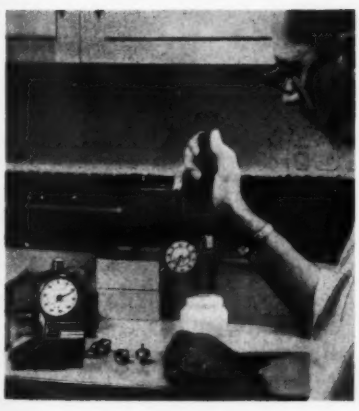
The new balancing machine also has a way of checking itself. After one of the torus units has passed its unbalance correction routine with a tailormade slug welded to its rim, it undergoes a balance recheck.

Once again it is spun and if unbalance is beyond the ¼ ounce-inch limit, it is shifted to a "reject" conveyor. If it is within limits, it is automatically stamped "accept."

This electronic precision of the balancing operation, combined with the exacting recheck cycle, assures Hydra-Matic transmissions of the most uniformly balanced fluid couplings possible.

Dial Gages Speed Checking of Spray Can Valve Seals

In the pressure type spray cans which are extensively used for shaving cream, insecticides, hair sprays, paints, protective coatings, whipped cream, and many other products, the top of the can is sealed by a pressure valve. When this seal is pressed onto the can, it must extend a certain distance into the can to prevent pressure leaks. It may be determined whether the pressure seal is properly seated by measuring the location of the external groove of the seal after it has been pressed on the can. The diameter of the groove is also checked to discover whether the seal is tight around the edges.



Two dial indicator gages to check these conditions are now being furnished by Federal Products Corporation, Providence, Rhode Island.

The groove location is checked by Federal Model 444 P-161-W1319. The gage rests on top of the can and a hook-like contact fits into the groove. Thus the exact location of the groove can be accurately determined and read on the dial indicator. This is a quick and accurate inspection that does not require a great deal of skill, and with a minimum of training, inspectors can get very precise readings.

To check the ID of the groove, a specially designed caliper gage (Federal Model 149 P-611) is used. This gage has a thumb lever which squeezes the gage arms together to allow the contacts to enter the groove. The lever is then released and the contacts expand to take a reading. The true groove diameter is read on the dial because the contacts are shaped correctly for this particular type of groove and there is no danger of operator influence distorting the result.

These are inexpensive gages which have proven themselves to be great savers of both time and money. One user reports that he saved 90% of the time formerly needed to make these two inspections and a decided cost reduction was realized through increased accuracy.

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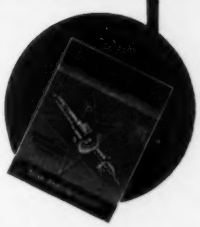

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RECENT DEVELOPMENTS IMPROVE PRODUCTION OF ACCURATE HOLES

THROUGHOUT the metalworking industry, there is an increasing requirement for the production of accurate holes. This applies to hole size, roundness, and straightness, with the degree of accuracy dependent upon the product design.

Conventional manufacturing procedure would call for first drilling these holes, then finishing or refining them by reaming, boring, broaching, honing, or some combination of these operations.

These multiple operations are expensive. If some of them can be eliminated, or at least simplified, the savings can be important. Therefore, considerable study has been made of hole-producing and hole-finishing tools. Results of several such studies, made by National Twist Drill & Tool Co., are reviewed here.

The double margin twist drill is one of the most notable of recent drill developments. It is being used advantageously by the aircraft industry to drill straight, accurate holes for high strength rivets and fasteners. (This development will be discussed more fully in a later issue—Ed.)

The Gun Drill

The single flute gun drill is usually considered to be a deep-hole producing tool. This is because it can produce accurately-sized straight holes. For shorter holes which require these same properties, gun drills have recently been used successfully. Such short holes are often found to be so accurate that finishing operations such as reaming, boring, and broaching can be eliminated.

When gun drilling short holes, it is usually most convenient to rotate the gun drill rather than the workpiece. This simplifies fixture design and makes for easier loading and clamping. Accurate spindles and alignment between spindles and guide bushings are essential. The guide bushing should contact the work so that cutting fluid and chips will flow out through the bushing. The bushings must fit the drill head closely; this insures accurate entry of the unbalanced gun drill into the workpiece.

Various machines have been adapted to this class of work. However, small single- or multiple-spindle precision boring machines are particularly suitable for such conversions. Both Target* (trepanning) and Center-cut (conventional) gun drills as shown in Figure 1, can be used. The Target gun drill will usually produce a more accurate hole, but on high production it sometimes introduces a problem of core removal and disposal. Since cutting fluid pressures are high (300 to 1000 psi) and the flow is appreciable, good splash guards or enclosures must be provided on the machine.

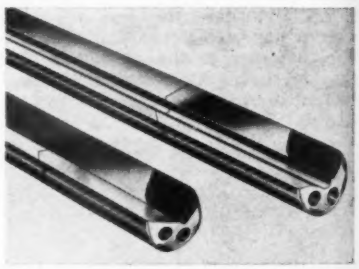

Fig. 1. Cutting ends of Center-Cut (lower) and Target gun drills. With suitable equipment, these drills can produce close tolerance straight holes having low values of surface roughness.

*"Target" is the registered trade name covering gun drills manufactured under Patent No. 2,418,021.

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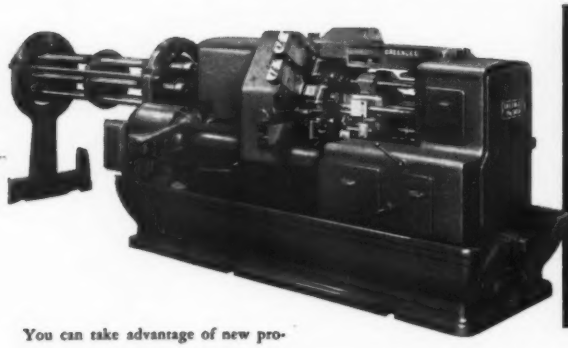

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Figures 2 and 3 show such an operation on a 6-spindle, double ended New Britain boring machine. Three parts are drilled on each end with loading and drilling operations alternating. The part is an automotive component shaft made of AISI-B1113 steel. A hole of .282 to .286" dia is drilled axially through part of the length. Centercut gun drills with solid carbide heads are rotated at 3200 rpm at a feed of .0008 ipr. The total drill feed length is 4½". Cutting fluid is delivered to the machine at a rate of 30 gpm.

Fig. 2. Gun Drill operation on a New Britain 6-Spindle double-end boring machine. Operator loads and unloads three pieces while three are being drilled.

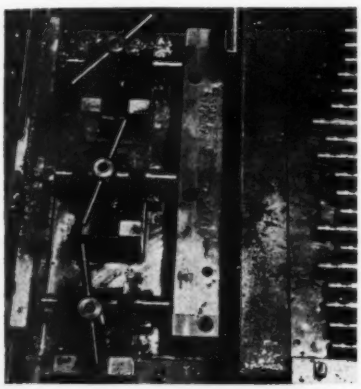

Fig. 3. Top view taken from rear of the New Britain boring machine. It shows three parts clamped in position in the right hand station.

Three views of the part, including sections before and after drilling, are shown in Figure 4. Concentricity and straightness are maintained. The hole finish is comparable to that obtained by reaming. With a mild steel such as AISI-B1113 it is sometimes difficult to attain a high finish, but as the hardness increases the finish generally improves. In some steels and in many non-ferrous alloys it is possible to produce gun drilled holes having a surface roughness of less than 25 micro-inches.

An unusual gun drilling operation on an exceptionally large part is shown in Figure 5. The part is a steel block 96" x 60" x 30", weighing about 30 tons. A total of 264 holes, 2⅛" and 2⅝" dia are required through the 30" thickness of the block. Because of close hole spacing, the original requirement was that the holes be straight and come through the opposite side of the block within .007" of the starting locations. With the Target gun drill these tolerances were held, the average error being only .002". The machine used was a large horizontal boring mill fitted with a special heavy duty guide bushing bracket and equipped with a high-pressure high-volume cutting fluid supply system.

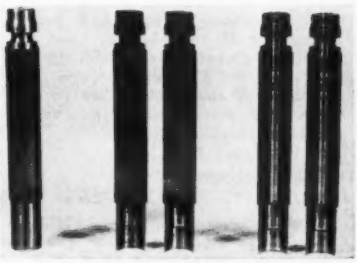

Fig. 4. Three views of the shaft that is gun drilled in the setup shown in Figs. 2 and 3. The sections show the part before and after gun drilling.

. . . Continued on Next Page

How to Cut the Cost of Gaging Threads

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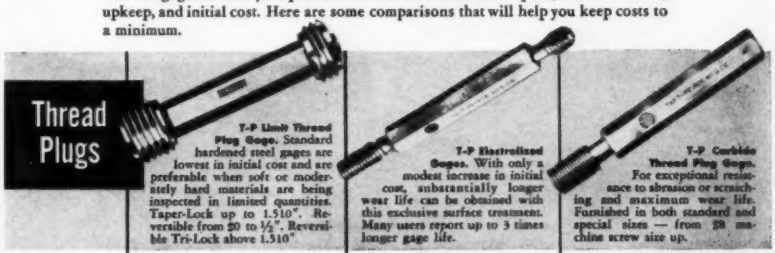

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T-P Limit Thread Plug Gage. Standard hardened steel gages are lowest in initial cost and are preferable when soft or moderately hard materials are being inspected in limited quantities. Taper-Lock up to 1.510". Reversible from 20 to ½". Reversible Tri-Lock above 1.510"

T-P Electrolized Gages. With only a modest increase in initial cost, substantially longer wear life can be obtained with this exclusive surface treatment. Many users report up to 3 times longer gage life.

T-P Carbide Thread Plug Gage. For exceptional resistance to abrasion or scratching and maximum wear life. Furnished in both standard and special sizes — from #8 machine screw size up.

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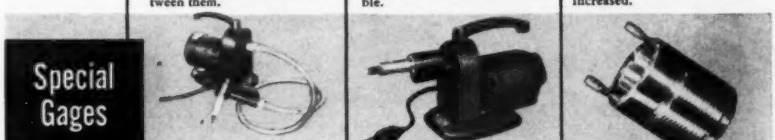
T-P Thread Ring Gages. Lower in initial cost than other gages for external threads, they check a combination of all thread errors but cannot distinguish between them.

T-P Adjustable Thread Snaps. Faster than ring gaging, and just as accurate, they check lead, angle, and all other thread elements. Pitch diameter is variable.

T-P Roll Thread Snaps. Same as adjustable, with *rolls* for gaging members. Since gaging members rotate, wear is spread over greater surface and service life increased.



Special Gages

T-P Rotochek (Flexible Shaft Model). Fastest thread gaging method yet devised. Push—and the gage screws into the work. Release the pressure and it stops. Pull—and it disengages. Can be used with most standard T-P plug or ring gages.

T-P Rotochek (Bench Model). Permits bringing work to gage, instead of gage to work. Like flexible shaft model, records indicate it triples rate of parts inspection.

T-P Thread Concentricity Gage. Typical of the infinite variety of special gages made to order by T-P every year. This one checks size and location of internal threads.

For the complete story on these items and many more, send for your copy of the Taft-Peirce Handbook.

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, R. I.

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Fig. 5. Gun drilling 264 holes through a 30-ton block of steel on a large horizontal boring mill. Holes are 2⅛" and 2⅜" dia. through 30" thickness of the block. With Target Gun drills, average straightness error is less than .002".

The Gun Reamer

A further development of the gun drill is the gun reamer. Like the gun drill, this is a single fluted tool. The cutting fluid, supplied through the shank, is introduced at the rear of the reamer head so as to reach the cutting zone and to wash the chips ahead of the tool through the hole being reamed. Such a tool is shown in Figure 6. These tools are usually made with solid carbide reaming heads. Because of the small amount of stock being removed, cutting forces are small; the hole finish and size are very good.

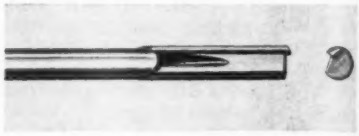

Fig. 6. Gun Reamer with solid carbide head used for reaming valve guides as shown in Fig. 5.

Gun reaming has been successfully applied to reaming integral valve guides in the cylinder heads for modern overhead valve automotive engines. One such setup is shown diagrammatically in Figure 7. The gun reamer is mounted concentrically with a valve seating tool to insure concentricity between the valve seat and the valve guide. Both tools operate at different rotational speeds and at different feed rates. In this case, the gun reamer is rotated at 3600 rpm and the feed rate is 14 ipm. The cutting fluid supply pressure is 75 psi. This cylinder head is made of automotive cast iron having an average hardness of 235 BHN. Hole diameter is held to better than .3432 to .3442", a total tolerance of .001", and the hole length is 2⅜".

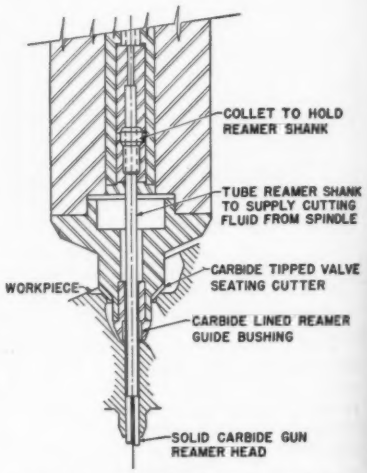
COLLET TO HOLD REAMER SHANK
TUBE REAMER SHANK TO SUPPLY CUTTING FLUID FROM SPINDLE
CARBIDE TIPPED VALVE SEATING CUTTER
WORKPIECE
CARBIDE LINED REAMER GUIDE BUSHING
SOLID CARBIDE GUN REAMER HEAD

Fig. 7. Diagram of setup used for gun reaming integral valve guides in automotive cylinder heads. Valve seat is furnished first with large cutter. Seating cutter is then retracted slightly to clear seat, spindle speed is increased and gun reamer fed through valve guide holes.

This arrangement is so reliable that it is incorporated in a number of stations of the large automatic transfer machine used for producing the cylinder heads.

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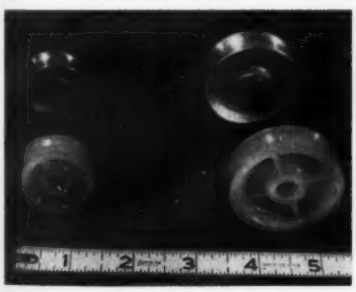
The examples cited here are only a few of the recent advances in accurate hole production techniques. None of these tools are cure-alls, and all require careful individual engineering and application for their successful use. When this is done, the cost of accurate hole production can be considerably reduced.

Converting Metal Boat Pulleys to Molded Nylon

A manufacturer, engaged in the sailboat industry, had been concerned with the problem of canvas top surfaces and the lacquered wood surfaces of sailboats being scratched and nicked by the continual contact of the many pulleys required on sailboats.

In seeking a solution to this problem, it was suggested by Dayton Rogers Manufacturing Co., Minneapolis, Minn., that the present type of metal machined pulleys be replaced by nylon pulleys. Following through on this suggestion, a nylon sample was made up by machining the different parts. This sample was tested by the boat builder. He found that, although nylon is extremely strong and tough, there is enough resiliency in it to give sufficient cushioning effect when the pulley is dropped or knocked on the boat, so that scratching and denting is eliminated.



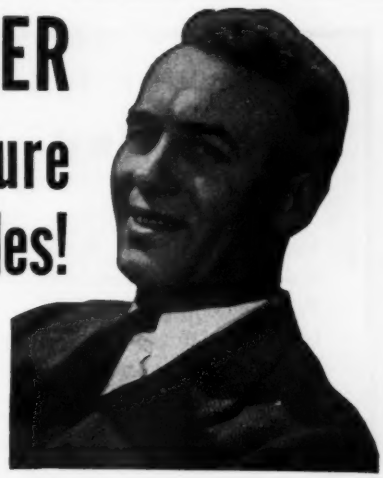
In checking the costs of nylon pulleys and comparing them with his present prices on metal pulleys, he found he could buy a small pulley mold for $180, and a mold for the large pulley at $190. He also found he could buy 1000 parts of the small pulley for 13.5c each and 1000 parts of the large size at 16.5c each. The total cost was less than that at which he could buy 1000 pulleys of each of his metal type pulleys. On subsequent reorders the cost will be appreciably less.

A further advantage of the Nylon pulley over the metal pulley is that Nylon is a self-lubricating material. Formerly this boat company had to use an oilite bearing to ride on the pulley pin, on which these pulleys are assembled, but now he can eliminate the oilite bearing and let the Nylon act as its own lubricating and bearing surface.

One other factor very pleasing to this boat builder is that the overall weight of the pulleys on one boat has been decreased by about 5¾ lbs. Since his sailboats are used almost entirely for racing, this reduced amount of weight can be very advantageous. In other lines where overall weight is important, such saving in weight can be extremely essential.

This case history typifies one of many cases where parts can be converted advantageously from one type of material and construction to another, in this case plastics, and where the final result is not only a saving in dollars, but also a definite improvement in usage.

"HOVIS WASHER DIES have sure solved our troubles!



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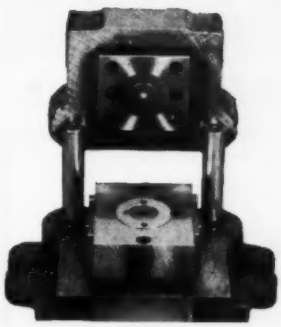

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Precision Slicing Germanium Wafers for Transistors

Precision slicing of brittle, crystalline semi-conductors such as germanium and silicon into wafer form has been a problem confronting manufacturers of transistors and other devices employing these elements.

The transfer of transistors, those minute substitutes for vacuum tubes, from the laboratory to the production line, has posed some important problems. One is how to cut these critical materials into the tiny but dimensionally accurate pieces that form the working part of a transistor at the production rates required to meet a rocketing demand. Another problem is that of reducing waste in cutting these extremely expensive materials; germanium, for example, sells at about $400/lb.

To meet this important problem, The DoAll Company, Des Plaines, Illinois, has developed the Microtomatic precision slicing machine. Raw germanium, prior to cutting, is a crystal, generally in the form of an ingot 4" to 5" long and up to 1½" dia, though its shape is often more triangular or rectangular than cylindrical. For most transistors it must first be sliced into thin wafers 0.010" to 0.015" thick. Where power transistors are the end product, the entire wafer may be used but more often it is cut or "diced" into squares as small as 0.050" on a side, after which it is lapped and etched to its final thickness.

To achieve the desired electrical characteristics in the finished transistor, the crystal must be sliced relative to its crystallographic planes which are determined by x-ray examination. Because of this requirement slicing is not always done at exact right angles to the longitudinal axis of the crystal bar. As most commonly done up to now, the crystal is cemented to a work holding plate and set up on a work table in proper relation to the cutting plane of a circular diamond saw blade large enough in diameter to cut through the entire cross section of the crystal. For a 1½" diameter crystal bar, the thinnest practical circular diamond saw for this method cuts a kerf (slot) 0.030" wide. Obviously, in producing 0.015" or 0.020" thick wafers,

Fig. 1. Microtomatic precision slicing machine, equipped with motorized fixture for slicing germanium transistor wafers.

Fig. 2. Compound headstock permits aligning proper crystallographic plane to cutting plane of saw. A germanium crystal is shown cemented to headstock and aligned in the proper plane.

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more of this expensive material is reduced to dust than to usable wafers.

Slicing with the Microtomatic

The Model MTA-1 Microtomatic precision slicing machine is an automatic, hydraulically actuated, circular sawing machine employing a thin circular diamond saw blade for slicing ingots. A 6" by 18" work table provides ample room for work holding fixtures. The table moves on hand-scraped ways feeding the germanium or silicon ingots into the cutting wheel at rates as low as

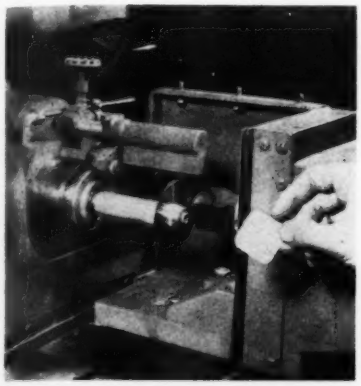

Fig. 3. Close-up of Microtomatic work table and slicing fixture in place. (Guards are removed). Workpiece is rotated so that small diameter thin circular saw can be used. Thus more wafers are cut from each crystal with less waste.

1/16 ipm. Easily adjusted trip dogs control the length of cutting stroke and provide automatic quick return at speeds up to 50 fpm. When slicing, automatic cross indexing takes place on the return stroke. Cross indexing can be set at the hydraulic control panel to produce slices of any desired thickness accurate to ±0.0005". Stops are provided so that cross indexing can be adjusted to

Fig. 4. The machine setup for dicing germanium wafers. Spindle shaft carries 12, 3" dia x 0.015" diamond saws on 0.250" spacing. Blanks, 0.250" square, are produced in two passes.

the length of the ingot or ingots being sliced. Whether one or more ingots are held in fixtures on the table or whether the DoAll slicing fixture is used, the slicing operation is automatic requiring no attention by the operator until the entire work-load is reduced to wafers.

The slicing fixture designed for use on the new Microtomatic makes it possible to use smaller, thinner wheels, thereby reduces waste and increases the number of usable transistor blanks obtained from each crystal ingot. Setting up for precise automatic slicing on the Microtomatic is not difficult. Essentially, the fixture is a motorized precision headstock that can be mounted on the work table and accurately aligned parallel to the cutting spindle. Adjustable keys on the fixture base permit quick, accurate alignment of fixture to spindle. The face plate to which the end of a germanium crystal can be cemented, is a compound assembly which can be adjusted to bring the crystallographic plane into coincidence with the plane of rotation. The crystal can then be rotated at an appropriate speed during the cutting stroke. Consequently, a

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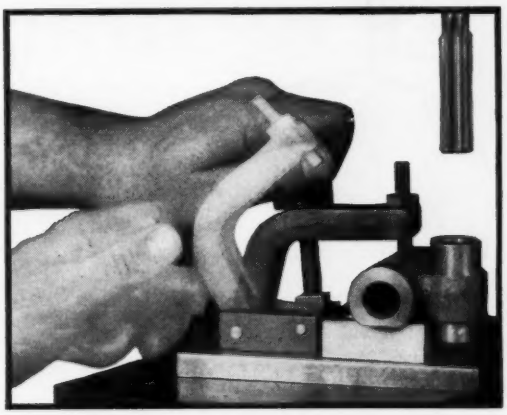

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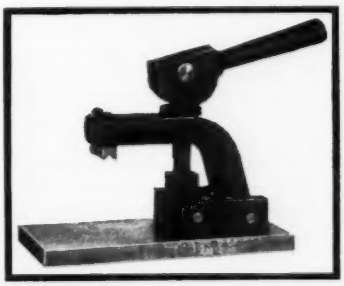
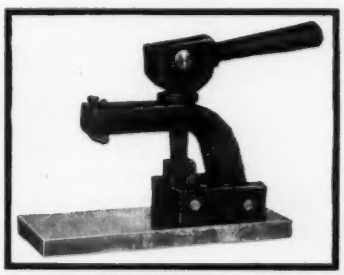


Block Adaptor



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saw only large enough to cut to the center of the workpiece will suffice. For crystals under 1½" dia, a 3" saw may be satisfactory. Such a circular blade reduces only 0.015" of material to dust.

Dicing

Some large power transistors make use of a complete wafer as produced by the slicing operation but most transistor blanks are made by cutting the thin wafers into tiny squares. The wafers are held for dicing by cementing them to ceramic plates which are, in turn, held by a fixture on the work table of the Microtomatic. The fixture is a serrated chuck with back stop and clamps to hold up to 5 4½" square plates. Each plate can be covered with germanium or silicon wafers so that a full work-load might be 20 or more wafers.

The Microtomatic spindle for dicing is a special high-speed unit with a 3½" extension to permit mounting and spacing of a number of 3" diameter circular diamond saw blades. A typical setup might be 12 blades spaced 0.250" apart so that the entire width of the fixture is covered at a single pass. Slow table feed is used, and the depth of cut is set to cut through the wafers in one stroke.

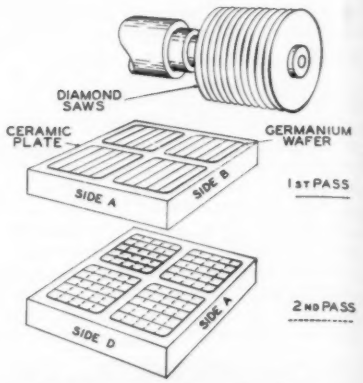


Fig. 5. Diagram illustrating the procedure by which 0.250" square blanks are diced.

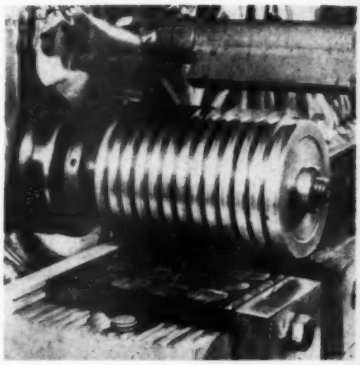


Fig. 6. Close-up of dicing operation.

If wheel spacing corresponds to the desired blank size, the plates are turned 90° and the strips of wafers are diced in a second pass. If very small blanks are required, it may be desirable to space the blades twice or three times the width of a single blank because the adhesive area on very small blanks is reduced to a point where the force of the blades, cutting simultaneously at both edges, tends to tear the blanks away from the ceramic mounting plate. Using wider spaced blades, the blanks are cut on one side. Then, the accurate cross index is brought into play to position the work for a second cut along the other side.

Last year was the "biggest year for standards" in the history of the American Standards Association. The Association approved a total of 238 American Standards from Jan. 1955 to Jan. 1956 as contrasted with 153 in 1954. At the present time, there are 388 projects for standards being carried on under ASA auspices, according to Vice Admiral George F. Hussey, Jr., managing director.

TOOL MAKERS, Inc. turns to pivot HIGH-SPEED STEEL PUNCHES

HOW WOULD YOU SOLVE THIS PROBLEM?

Pierce .050 thick annealed No. 30 stainless steel washers of .125 diameter with a .035 diameter hole. Screw-machining obtained an average of 5 holes per drill at a cost of approximately 45¢ per hole.

HERE'S HOW TOOL MAKERS, Inc.,

of Culver City, California, solved the problem. These famous tool designers and builders incorporated Pivot Straightground Whipsleeved High Speed Steel Punches in a die with 10% clearance.

Mr. Earl Ellsworth, Vice-President, reports:
"We now average 500 to 1,000 parts, and have obtained as high as 3,000 parts per punch. Since going to Pivot Punches we are obtaining completely burr-free holes and the complete washer costs us less than 10% of previous methods."

See how Pivot Punches can increase the quality and quantity of your production at decreased costs. Send for complete catalog of straightground, whipsleeved or cylindrically ground punches and piercing accessories. Prices listed. Write Dep't. T.P.

(Ask for our new Free Booklet "55 Problems and Solutions")
A helpful handbook for all Tool Engineers!

tendra-treated FOR EXTREME HARDNESS

pivot punch and die corp.
NORTH TONAWANDA, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 186

NATION-WIDE SALES FORCE CREATED BY MICHIGAN FIRM

Michigan Drill Head Co., Detroit engineers and manufacturers of production machines and drilling equipment, recently announced completion of another major expansion program. The firm has blanketed the United States and Canada with sales representatives to "trouble-shoot production problems and keep the company's engineering staff fully informed of the specific problems encountered," according to Jerome E. Sullivan, president.

The New England states will be serviced by the G. W. Bush Co., West Hartford, Conn.; Metropolitan New York, Long Island, and northern New Jersey, The John Hoffman Co., Irvington, N. J.; eastern Pennsylvania, Delaware, Maryland, and the District of Columbia, John Leafstrom of Philadelphia; western Pennsylvania and West Virginia, The Rees Machinery Co., Inc., Pittsburgh.

Eastern and central New York state, William G. Harvey Co., Syracuse; western New York state, George Shoenhair, Buffalo.

Ohio, Myers Tool Service, Cleveland, assisted by Gene Siferd of Lima, Ohio; Metropolitan Detroit, Michigan Drill Head Company's staff, working out of the company's plant; the balance of Michigan, C. Walton and Bud Bender, both of Flint.

Neff-Kohlbusch & Bissell of Chicago will represent the firm in Illinois, Indiana, and Wisconsin, with Fred Berger sales manager for greater Chicago and C. O. Heckel of Rock Island servicing the rest of the state. J. Hoss, Indianapolis, the state of Indiana; and Drury Clark and Jack Miller, Milwaukee, servicing Wisconsin.

The Dixie Mill Supply Co., New Orleans, will represent the south central states; and Marshall Supply & Equipment Co., Tulsa, the west central states.

Southern California is being serviced by Franklin E. Smith & Associates of Maywood, Calif., and Karl M. Greiner is sales representative in northern California, Oregon, and Washington.

Barker Industrial Equipment, Ltd., Toronto, represents Michigan Drill Head Co. in all the provinces of Canada.

Orders for industrial equipment and supplies rose again in February, reports the American Supply & Machinery Manufacturers' Association. Only once since the Korean War has their index exceeded the February figure; in September, 1955.

"PRODUCTION AND PLANT IDEAS ON AIR EQUIPMENT"

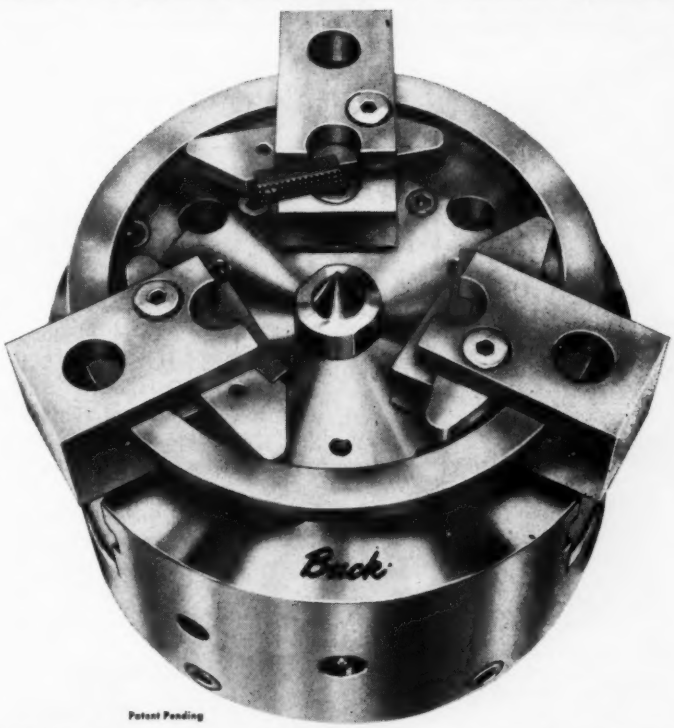
Gardner-Denver Company has announced publication of "Production and Plant Ideas," a bimonthly with articles of special interest to tool design and plant engineers. Short "idea" articles on how air-powered equipment can be profitably designed into many production operations will be its specialty, along with discussions on how to simplify and save time in plant maintenance work.

The current issue, for example, describes a multiple hole drilling production line operating using Keller Tool "Airfeedrills"; air motor power applied to positioning blanks in gear cutting to replace the time-consuming hand wheel spinning method; and how to increase electrical assembly production through the use of multiple nut setters.

To receive copies of Production and Plant Ideas regularly, write to Keller Tool Division, Gardner-Denver Company, Grand Haven, Mich.

Another *Buck* FIRST!

NEW COMPENSATING POWER CHUCK



Patent Pending

Ends the Friction that Breaks Centers and Distorts Work

This Buck development begins a new era of greater efficiency in compensating chucks.

Gone is all the friction of internal compensating mechanisms that, in the past, have often forced undue pressure on work to distort it or break centers.

The Buck compensating mechanism is all outside of the chuck body. As jaws move in on work, one jaw pad always makes first contact. This instantly swings its rocker arm to the controlling ring, which in turn brings the other jaws up to contact—with minimum pressure on the work.

The Buck operates equally well with the machine running or not—allows automatic loading and unloading. And its compensating mechanism increases gripping power to permit more rapid stock removal.

Since this is a Buck, the patented Buck Ajust-Tru principle can be used to position the center absolutely dead true. Work-holding diameters can be changed, within practical limits, by replacing jaw pads.

This is also a dual-use chuck. Compensating mechanism can be removed and the chuck used as any Buck Power chuck.

Sizes and prices: 6"—$475; 8"—$550; 10"—$650; 12"—$700. F.O.B. Kalamazoo. In ordering give the mean diameter of stock to be chucked so that proper size jaw pads can be supplied.

BUCK TOOL COMPANY
518 SCHIPPERS LANE
KALAMAZOO, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 187

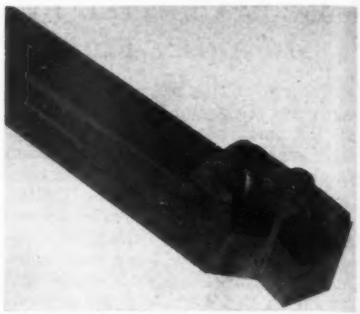
SWITCH TO CLAMPED INSERTS REDUCED MACHINE DOWNTIME

Clamped insert tooling — which features longer tool life, quick tool changing and simplified tool maintenance — is resulting in a considerable reduction in tool changing downtime and grinding costs, according to Kennametal field reports.

A case in particular is that of a textile machinery manufacturer who switched from standard brazed tip tools to Kennametal's tooling—which was used for rough and finish straddle facing and chamfering 15⅜" OD x 1½" wide cast iron transmitter gears.

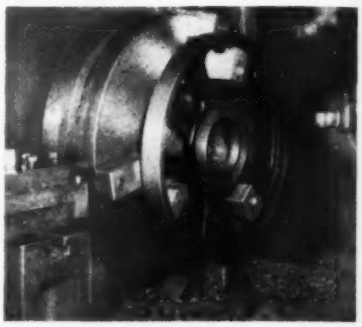
One two-tip brazed special tool had been used in the textile manufacturer's setup for finish facing one side and chamfering in a single pass. However, tool changing proved troublesome. Even with only slight wear on the chamfering tip, it had to be reground each time the facing tip was reground to maintain relationship of the tips.

The tipped tool was replaced with a special Kendex tool, manufactured by Kennametal, Inc., Latrobe, Penna., utilizing two clamped "turnover" type square inserts which



made possible indexing to a new cutting edge in seconds without checking the workpiece. The inserts provide eight indexable cutting edges — four on each side of the insert — and are interchangeable.

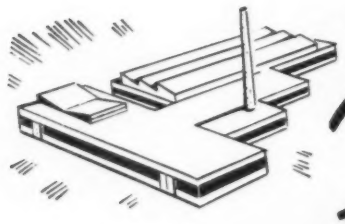
When all the cutting points had been used, the facing insert was switched with the chamfering insert — which cuts with the central portion of its cutting edge — and the cycle repeated.



The gears, machined in a Potter and Johnston lathe, were cast iron with molybdenum. Feed was 0.014 ipr. Roughing was completed at 39 rpm and 157 sfpm. Finishing was at 74 rpm and 298 sfpm. Depth of cut varied from ⅛" to 3/32" roughing and was 1/32" for finishing.

COMPARATIVE RESULTS

Rough Straddle Facing	
Standard Brazed	100 pcs per grind 2,000 pcs total tool life
Kennamatic (Style RAR and RAL-16A)	2,400 pcs per grind (300 per index) 48,000 pcs per insert life
Finish Straddle Facing	
Single Point Brazed Tool	35 pcs per grind 700 pcs total tool life
Kennamatic (Style SFR-16A square)	1,000 pcs per grind (125 per cutting point) 20,000 pcs per insert life
Facing and Chamfering	
Special Two-Tipped Brazed Tool	40 pcs per grind 800 pcs total tool life
Kendex (with two square inserts)	800 pcs per insert (100 per point) (Switching—800 additional pcs, no grinding)



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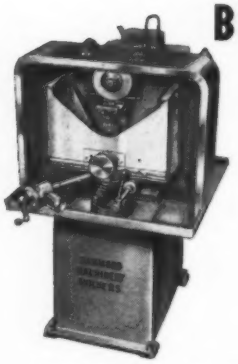
AMERICA'S LEADING MANUFACTURERS
Hammond
CARBIDE TOOL and CHIP BREAKER GRINDERS



SAVE TIME · TOOLS · WHEELS with America's "Choice" and most complete line of Carbide Tool, Chip Breaker and Diamond Finishing Grinders. *Over 6,000 in service.*

Clip this ad to your letterhead and Carbide Grinder Catalog will be sent by return mail.

CBW-6 Chip Breaker and Diamond Grinder. Other Models also available.

14-WD Wet or Dry 14" Carbide Tool Grinder. 6" and 10" also available.

Hammond Machinery Builders INC.

1631 DOUGLAS AVE., KALAMAZOO, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 188

INDUSTRY-EDUCATION COOPERATION CITED AT CINCINNATI

The cooperation of education and industry, linked together for 50 years at the University of Cincinnati, joined together last month in Cincinnati, Ohio, to celebrate the Golden Anniversary of the founding of cooperative education at the University.

Americade, National Association of Manufacturers' quarter of a million dollar traveling exposition, gave visitors to the campus a "look at tomorrow." America's technical advances of the past 50 years were reviewed in the "Panorama of Scientific and Industrial Progress," sponsored by Cyrus R. Osborn, General Motors vice president.

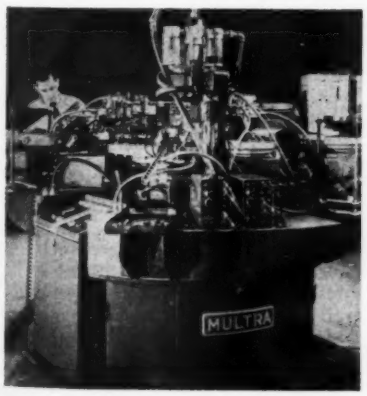
Frederick V. Geier, president of Cincinnati Milling Machine Company; Henning W. Prentis, chairman of the board of Armstrong Cork Company; Stanley C. Allyn, president of National Cash Register Company; and Charles R. Hook, chairman of the board of Armco Steel Corporation, were among the prominent industrialists taking part in the celebration which looked at past events and predicted future progress.

UNIQUE AND FLEXIBLE ASSEMBLY MACHINE

Attention has been called to a multi-purpose automatic assembly machine built by the Multra Corp., a subsidiary of Barnes Engineering Co., Stamford, Conn.; it is turning out 15,000 to 20,000 mercury batteries in an eight hour shift.

A unique feature of the machine is realized by simply changing the tools. In a few hours other products can be assembled on the same machine. Usually assembly machines are built to do a specific job without this versatility.

The Multra Machine automatically feeds, sorts, sizes, forms, orients and inspects five different battery parts which go to make up the assembly. These parts are of various materials, such as the metal cylinders and caps, felt, neoprene grommets, and even the liquid electrolyte which is metered into the assembly.



The heart of the machine is the six-foot diameter table which can accommodate 16 tooling stations.

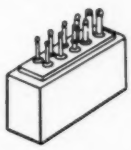
The machine shown is one of several on order from Multra Corp., for the P. R. Mallory & Co., Inc. and is in operation at Mallory's North Tarrytown, N. Y. battery assembly plant.

The Barnes Engineering Co. also builds automated units on the straight-line principle, as well as designs and manufactures infrared systems, instrumentation, and process control equipment.

National standards for uranium isotopes are the hopes of the newly-formed Committee of Uranium Isotopic Standards of the Atomic Energy Commission. The committee's standards should be of value to both the AEC and private industry for comparison purposes associated with analytical work.

Here's Everything
for Precision Boring and Internal Threading

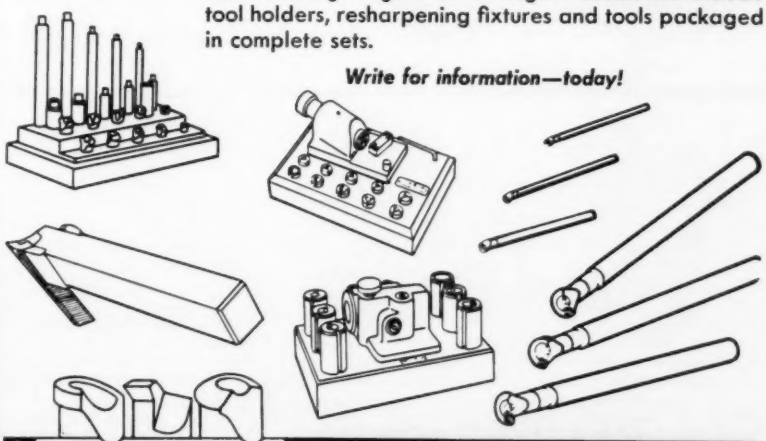
You'll find everything you need at Bokum for fast precision boring.



Due to the unique design—combined radial and helical back-off—Bokum tools provide constant clearance, permit faster machine operation. Resharpening is simple.

Bokum's new products include tools for cutting grooves for retaining rings and O-rings. Accessories include tool holders, resharpening fixtures and tools packaged in complete sets.

Write for information—today!



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BOKUM TOOL COMPANY, INC.

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CIRCLE INFORM-A-GRAM KEY NO. 189

DISEASES OF SKIN COSTING INDUSTRY UNNECESSARY TOLL

Occupational skin diseases are costing American Industry millions of dollars annually, and most of this loss is totally unnecessary, believes Dr. Louis Schwartz, retired medical director of the U. S. Public Health Service.

"A few simple preventive measures," he maintains, "could sharply reduce this annual toll in lost production."

Examinations made by him in plants employing a total of about 117,000 workers revealed 1,400 cases of occupational skin disease. On the basis of this test it appears that more than one percent of American industrial workers are affected with skin diseases of varying degrees of severity.

Protective clothing and protective ointments, says Dr. Schwartz, afford the best shield against most irritants found in industrial plants. The clothing should be properly designed to be light and comfortable but of an impervious material. Gloves, aprons, boots, and sleeves of natural rubber, synthetic rubber, or certain plastics afford adequate protection in most cases. The use of ointments can be facilitated if packaged in collapsible metal tubes.

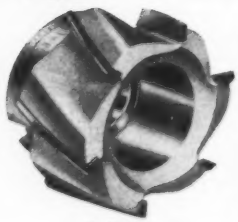
Personal cleanliness on the job is the most important single measure in preventing occupational skin diseases, Dr. Schwartz emphasizes. This calls for the location of washing facilities and showers near work stations and ready access to laboratory-tested skin cleaners and protective ointments. Individual tubes of ointments for employee use in the plant offer added protection.

The first line of defense against industrial skin diseases, Dr. Schwartz points out, should be the careful design and construction of new plants and factories. Proper ventilation will do much to keep irritants from workers' skins.

6 new ways to cut floor-to-floor time!

"Helicarb" milling cutters have a constant included cutting angle. The cutting load is uniformly distributed over the full length of the cutting edge. Cutters stay sharp longer, give far better dimensional control, better finishes, and greater stock removal. On many jobs, rough and finish cuts can be combined. Floor-to-floor time is drastically cut, reducing per-part cost.

These new cutters fully utilize the new advances in machine tool design. More and more shops—those that want a competitive edge—are using them. Why not you?

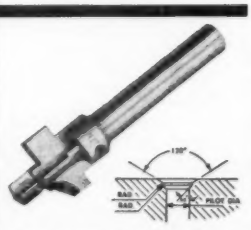

Shell Mills

End Mills

Slab Mills

Staggered-Tooth Side Mills

Interlocking Side or Straddle Mills


Attention! Hydraulic Parts Producers
If you produce A.N.D. 10050 port contours, investigate the Sonnet A.N.D. Port Contour Cutter that completes five operations in one pass!

HELICARB TRADE MARK
The original line of standard helical carbide milling cutters.

Manufactured by Sonnet Tool & Mfg. Co., 580 North Prairie Avenue, Hawthorne, California

CIRCLE INFORM-A-GRAM KEY NO. 190

NEW DIE STEEL PROVIDES HIGH SURFACE FINISH

A new medium-carbon-alloy die steel called MC-Mold and Cavity Steel has been especially designed to provide a die steel for molds and cavities where high surface finishes are desired.

This new product of the Vanadium-Alloys Steel Company, Latrobe, Pa., can be uniformly deep hardened at hardness ranges from 300 to 350 Brinell throughout sections as large as 20" x 10". High surface hardnesses are obtained by carburizing and then oil quenching according to tables prepared by the Vanadium-Alloys' Metallurgical Department. A low heat treating temperature is used in this process so that little or no movement takes place during quenching.

MC Steel is available either annealed or heat treated to a hardness of 300 Brinell at which hardness it is still readily machinable.

Diemakers who need highly polished mold cavities will welcome the new grade as it takes a fine finish with little danger of troublesome pits caused by metallic inclusions. It is particularly advantageous for the molding of clear plastics.

MC-Mold and Cavity Steel is generally sold in large rounds or blocks, according to customer requirements.

NSMPA Elects Officers at Milwaukee

Clarence A. Button, assistant to the executive vice president of the Mueller Brass Company, Port Huron, Mich., was elected president of the National Screw Machine Products Association at its annual meeting last month in Milwaukee.

Dana B. Jefferson, Jr., president of the Walker Manufacturing Company, Medford, Mass., is vice president, and Leonard R. Schaffer, president and treasurer of Mechanical Art Works, Inc., Newark, N. J., is the Association's new treasurer. Orrin B. Werntz, who has been with the NSMPA for 19 years, was re-elected executive vice president, and Margaret S. Ballinger, secretary.

The new president formerly served on the NSMPA board of trustees, is a former chairman of the Michigan district, has served on the Association's plant layout committee, and has been active in the organization for the past 15 years. He will leave soon for the West Coast to visit leading manufacturing units of the screw machine products industry to discuss industry futures in that area.

Four Honored by Tool Engineers

Four of tool engineering's experts were honored for their contributions to the field by the American Society of Tool Engineers, in Chicago during Tool Show week.

James H. Kindelberger, chairman of the board and chief executive of North American Aviation, Inc., received the Progress Award for his accomplishments in the field of engineering techniques and production methods, particularly in aircraft manufacture.

Orlan W. Boston, professor and chairman of the department of production engineering at the University of Michigan, received the Gold Medal Award as outstanding educator in production engineering and for his influential advocation of the importance of tool engineering in the national economy.

Edward W. Ernst, machine tool specialist for the Major Appliance Division of G. E., was awarded the Joseph A. Siegel Memorial Award for his contributions to the Society's growth and prestige and for his work in establishing sound policy and effective standardization practice.

Ralph E. Cross, executive vice president of The Cross Company, was singled out for the Engineering Citation for his contributions to peacetime industrial progress and national defense by sound counsel and service.

Stud-Press and Nut-Setter Unit

Recently, the Cleco Air Tools Division of the Reed Roller Bit Company completed a machine for completely assembling bearing caps on automobile engine connecting rods. Its capacity is 2000 connecting rod assemblies an hour.

The connecting rods are loaded on six-place fixtures on the continuous conveyor, which takes them to the first station for pressing in the studs.

The stud-pressing operation is accomplished electro-hydraulically without benefit of human aid. After the studs are assembled, the fixture moves on to the nut-setting operation.

Nut-setting is done with Cleco air motors which automatically engage the nuts and set them to the proper torque.

This development by Cleco falls in line with a definite trend toward automatic orientation and automatic running of nuts and bolts.

Convenient as ordering from your corner grocer!

Verson

PRESS BRAKES FROM STOCK

It's simple, quick and convenient. There are no involved proposals, no long waits . . . Verson standard press brakes are *immediately* available from stock.

Prices are the same too! Because of the large demand and high volume of sales you can still get a Verson Model 16-48, 16 ga. x 48″ capacity, for $1,455* and a Model 1062, 16 ga. x 78″ capacity, for $2,190*. All with that Verson quality, designed and built for long life and top performance.

Write for specifications, then just place you order.

New, Improved, Fully Enclosed VERSON SHEET FLOATERS

Easiest, most economical way to separate steel sheets and blanks. Available in 3 models, each with 7 sizes. Write for descriptive literature and prices.

**FOB Chicago, less dies.*

A Verson Press for every job from 60 tons up.

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MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES
TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

CIRCLE INFORM-A-GRAM KEY NO. 191

SHOP AIDS

The Importance of Carbon Dioxide as an arc shielding medium is discussed in the booklet, "Metallic Arc Gas Shielded Welding with Carbon Dioxide." The topics covered include: shielding gas, arc characteristics, welding atmosphere, power source, torch and control equipment, nozzle spacing and flow, welding wire, polarity, and materials. Also touched on are welding techniques and joint design. For your copy, write to The Liquid Carbonic Corp., 3100 S. Kedzie Ave., Chicago 23, or — **Circle Inform-A-Gram No. C1.**

The Fabrication of Parts made from stainless tubular products is discussed in a new technical folder. The folder furnishes pertinent information about various machining operations on stainless pipe and tubing. Tooling, power requirements, cutting oils, and finishing are also briefly covered. Copies of Folder TDC-182 can be obtained from The Babcock & Wilcox Co., Beaver Falls, Pa., or — **Circle No. C2.**

"Magnesium Base Alloys, Alloy Nomenclature, and Temper Designation." This booklet is identified by The Magnesium Association as an effort to arrive at a common system of alloy designations for use on prints and by purchasing agents. Included is a table of magnesium and magnesium alloys which shows a complete breakdown of alloy and temper designation and the specification identification for ASTM, Federal or Military, AMS, SAE, and individual company nomenclatures as used prior to the adoption of the standard nomenclatures. Copies of the booklet are supplied by The Magnesium Association, 122 E. 42nd St., New York 17, or — **Circle Inform-A-Gram No. C3.**

A Complete Report on the First Annual Contour Machining Conference is now available from True-Trace Corp., 9830 E. Rush St., El Monte, Calif. This conference accented the improvements in aircraft and instrument fabrication necessitated by difficult-to-machine designs, closer tolerances, larger contoured parts, and new, harder metals. Over 500 engineers participated in the speeches and panel discussions on tracer control techniques. **Circle Inform-A-Gram No. C4.**

This 1956 Edition of the RLM Specifications Book for industrial lighting units has been released by RLM Standards Institute, 326 W. Madison St., Chicago 6. The edition contains revisions in specifications on both incandescent and fluorescent industrial lighting units, as well as

new lighting data of special value to specifiers. Included are the new coefficient of utilization tables for 8 different lighting units and newly revised light distribution curves on RLM direct and semi-direct fluorescent lighting units. **Circle Inform-A-Gram No. C5.**

A Vacuum Calculator Slide Rule has been issued by F. J. Stokes Machine Co., Philadelphia 20. It is used for determining the needed pump capacity to evacuate a given volume to a specified vacuum in a given time. The calculator is also used to find the time needed to evacuate a given volume to a specified vacuum. A conversion table for high vacuum, metal vaporization data, and a graph of boiling points of solvents under vacuum are also given. **Circle Inform-A-Gram No. C6.**

Engineering Data on adhesives for honeycomb structures is found in a 20-page bulletin. Given are procedures and results of testing new resin-type and elastomeric adhesives used for bonding aluminum to kraft paper honeycomb core. Honeycomb sandwich materials and construction details are discussed and adhesive application procedures are described in detail. Get your copy of the bulletin from Adhesive & Coatings Div'n, Minnesota Mining & Mfg. Co., 423 Piquette Ave., Detroit 2, or — **Circle Inform-A-Gram No. C7.**

Abrasive Cutting is detailed in Catalog 1 issued by Allison Div'n, American Chain & Cable Co., Inc., 257 Island Brook Ave., Bridgeport 8, Conn. The catalog first tells what an abrasive wheel is and then discusses the economy of abrasive wheel cutting, both wet and dry cutting. General recommendations for the selection of Allison abrasive wheels are presented in tabular form. Also given is a standard marking system chart. In addition, the catalog tells about the types of cutting machines and pictures the wide variety of materials and shapes that abrasive wheels can cut. **Circle Inform-A-Gram No. C8.**

"Nitrocycle Case Hardening" is a handbook detailing an improved method of nitriding. The process is covered complete with tables, graphs, and illustrations. The advantages of pressure nitriding include simplification, improved case quality, and economy. For copies of the handbook, contact Imperial Works, Oil Well Supply Div'n, U. S. Steel Corp., P.O. Box 117, Oil City, Pa., or — **Circle No. C9.**

An Illustrated Technical Bulletin on Surface Measurement contains all the essential points of ASA Standard B46.1-1955 on surface roughness, waviness, and lay, plus much supplementary material. Topics covered include basic definitions; how to designate the characteristics of roughness, waviness, and lay on drawings; measuring the specified surface characteristics; and how the Profilometer measures average roughness height. Copies of this Technical Bulletin are available from Micrometrical Mfg. Co., 345 S. Main St., Ann Arbor, Mich., or — **Circle Inform-A-Gram No. C10.**

"A Complete Guide to Successful Silver Brazing" treats all aspects of brazing applications and problems in a basic, understandable manner. It discusses the brazing process, silver brazing alloys and fluxes, joint design, preparation for brazing, brazing methods, cleaning, and inspection. Also listed are the advantages of Silvaloy preforms. Copies of the booklet are made available by The American Platinum Works, 231 N. J. R.R. Ave., Newark 5, N. J., or — **Circle Inform-A-Gram No. C11.**

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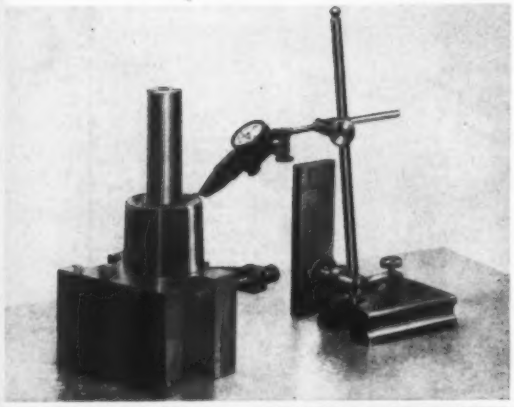
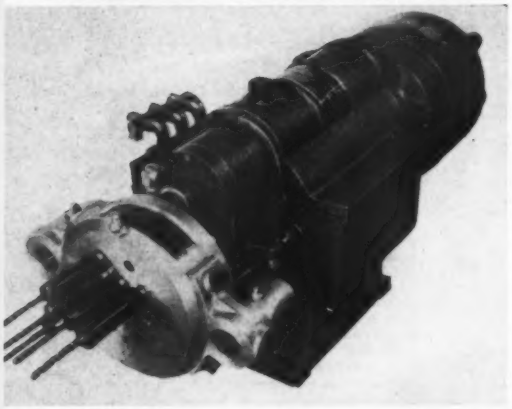


TEST INDICATOR . . .

Both setup work on a surface plate and the trueing of pieces in machine tools can be handled by the Check Master. This test indicator is an unusually sensitive instrument, responding to dimensional variations of 0.00002″. It is available with either long or short contact arms. Standard Gage Co., Inc., Poughkeepsie, N. Y., or— **Circle No. A1.**

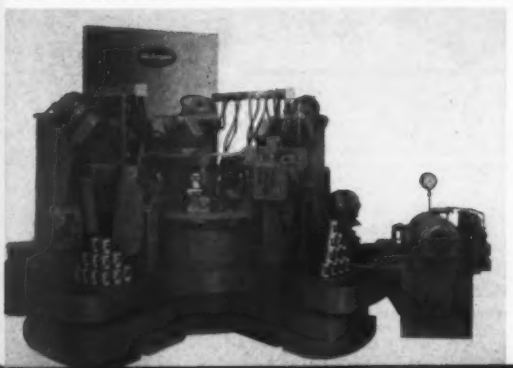
TRACER MILLING UNIT . . .

This 3-dimensional tracer milling unit makes it practical to take numerous cuts on large workpieces by moving the cutter rather than the workpiece itself. Therefore greater accuracy is maintained. Movements are manually controlled from a single pencil type stylus tracing unit. Sundstrand Machine Tool Co., Rockford, Ill., or — **Circle No. A2.**



DRILL UNIT . . .

This self-contained, high speed device has a drill capacity ranging from wire sizes to ½″ in steel. With the Ettco-Emrick Model DU-2 automatic drill unit, the drill depth can be set to less than 0.005″ within the 3″ maximum stroke. Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, or — **Circle No. A3.**

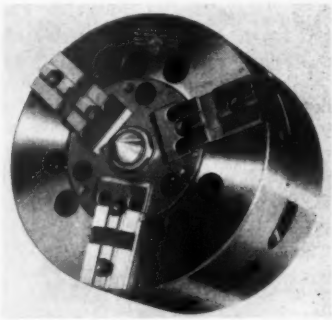


PISTON DRILLING . . .

This multiple special drilling machine finish drills 1200 pistons/hr. It performs 10 separate operations on each piston. This 8-station, horizontal dial-type machine features an automatic hydraulic index table and automatic lubrication. Michigan Drill Head Co., P.O. Box 4643, Detroit 34, or — **Circle No. A4.**

COMPENSATING CHUCKS . . .

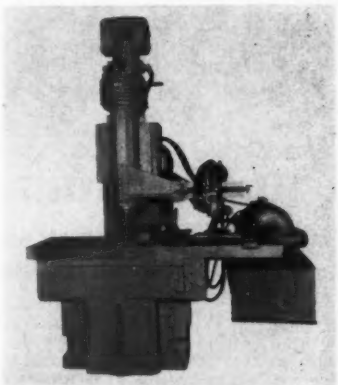
This line of 3-jaw compensating power chucks is designed for direct mounting on American Standard Types A-1, A-2, and B-2 flanged spindle noses. The chucks are used to drive work on centers when high speed,



heavy-duty cuts are required. Series 13100-A compensating chucks are available in 8″, 10″, 12″, and 15″ rated sizes. The Skinner Chuck Co., New Britain, Conn., or — **Circle Inform-A-Gram No. A5.**

3-D MILLER . . .

Mill left or right, forward or back, up or down with a 3-dimensional hydraulic milling machine that operates with a constant horsepower. The 3-D Hydro-Cycle Miller will cut circles to within 0.002″ tolerance. It semi-finishes the die or part, eliminating the use of at least one extra



machine and reducing bench work filing to a minimum. All movements are manually controlled by guiding the stylus arm over the die or part to be duplicated. Romulus Tool & Engineering, 13581 Huron River Dr., Romulus, Mich., or — **Circle Inform-A-Gram No. A6.**

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DIE CUSHION . . .

Independent individual pressure pad control is provided by this new type of pneumatic die cushion installation. The cylinder and piston section have maximum overlap, compensating for

off-center loading of the pin pressure pads. It can be operated either on standard shop air-line pressure, or be equipped with a booster pump with a maximum 200 lbs air-line working pressure. Dayton Rogers Mfg. Co., Minneapolis 7, or — **Circle Inform-A-Gram No. A7.**

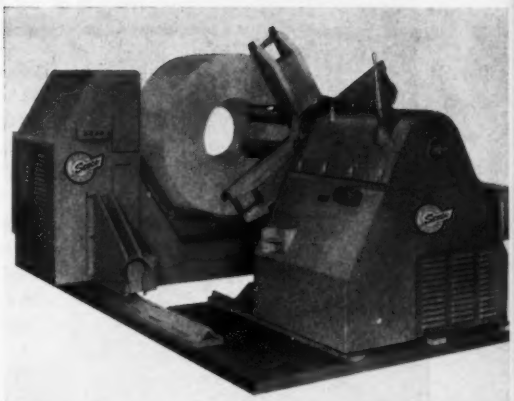
GEAR CHAMFERING . . .

Simultaneous chamfering of both sides of a gear is performed by this new single station deburring and chamfering machine. Model BME-14 Duplex

Burr-Master will handle spur gears, helicals, and straight sided as well as involute form splines from ⅝″ to 6½″ pitch dia at a production rate up to 5 teeth/sec per side. Radial location and indexing of workpiece is taken from the gear teeth proper. Modern Industrial Engineering Co., 14230 Birwood Ave., Detroit 38, or — **Circle No. A8.**

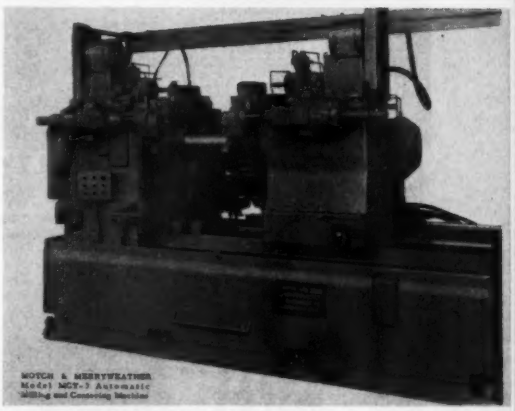
COIL LOADER . . .

Reduce, to a minimum, the downtime for reloading coil stock with this power-lift coil loader. It can be loaded without interfering with production. The complete movement of the coil, both lateral and vertical, is by electrical power and is pushbutton controlled. Sesco Inc., 8881 Central Ave., Detroit 4, or — **Circle No. A9.**



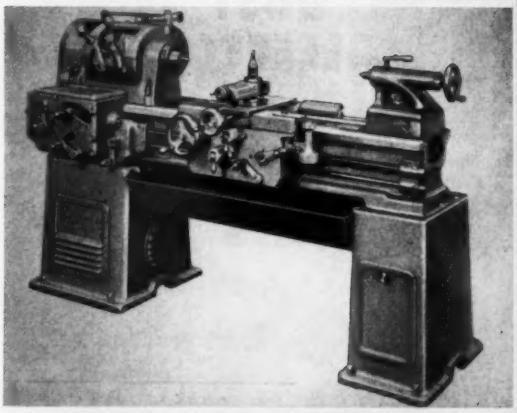
MILLING AND CENTERING MACHINE . . .

Designed to meet the accuracy and production demands of tracer-controlled and automatic lathes, Model 3 MCT is quickly set up for lengths up to 48″ and drills to a depth of 4″. Loading and unloading, milling, and center drilling are simultaneous. The Motch & Merryweather Machinery Co., Machinery Mfg. Div'n, 888 E. 70th St., Cleveland 3, or — **Circle No. A10.**



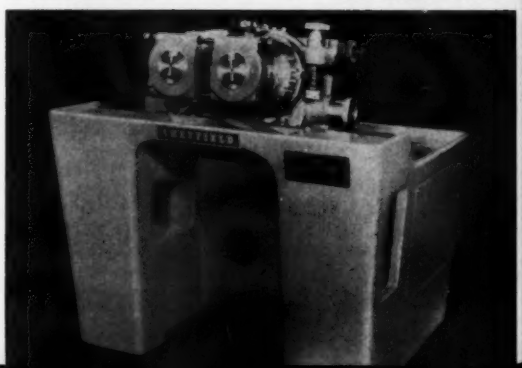
ENGINE LATHE . . .

An improved gear box on Model GH 16″ geared head engine lathe provides a thread range of 3 to 184 threads/in with 48 separate threads and feeds. Both feed rod and lead screw are provided. This lathe is one of the heaviest in the medium duty class. Get Bulletin A56 GH from The Carroll-Jamieson Machine Tool Co., Batavia, O., or— **Circle No. A11.**



THREAD ROLLING MACHINE . . .

High production thread rolling of studs and machine screws, etc. is performed by a new type circular roll threading machine. Equipped with hopper feed, it will produce up to 5200 parts/hr, ranging in thread size from ⅛″ to ¾″ O.D. by 2″ long. Murchey Div'n, The Sheffield Corp., Dayton 1, O., or — **No. A12.**



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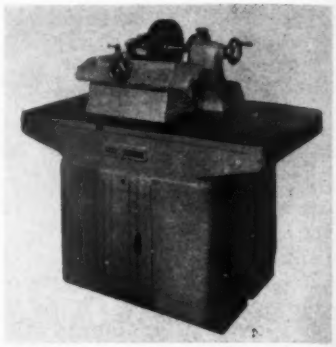
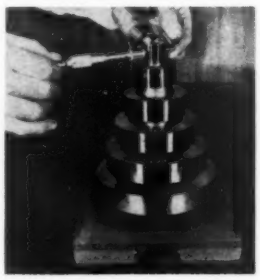
CIRCLE INFORM-A-GRAM KEY NO. 1962

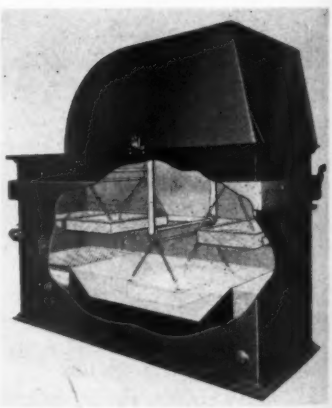
Two New Models have been added to the line of Portelvator elevating tables produced by The Hamilton Tool Co., 832 S. Ninth St., Hamilton, O. Models "35" and "50-6" (shown) have lift capacities of 3500 lbs and 5000 lbs respectively. They are 6-wheel models. The company will supply literature about these and other Portelvator units, or — **Circle Inform-A-Gram No. A13.**



Inspect Spur Gears up to 25½" O.D. as well as splines, for accuracy of tooth size, spacing, eccentricity, and parallelism with this new gear checker. Spur gears and splined parts up to 11⅜" between centers can be accommodated on Red Ring Model SIC-24 in. It features a type of slot design in the table surface which positions the various checking units in precision straight line and right angle locations. National Broach and Machine Co., 5600 St. Jean Ave., Detroit 13, or — **Circle No. A14.**



Test the Accuracy of Shop Micrometers with this master gage set. The Mikemaster consists of 6 pyramided lapped, hardened, and normalized steel cylinders graduated in size from 1" to 6" dia and calibrated to 4 decimal places. Size Control Co., 2500 W. Washington Blvd., Chicago 12, or — **Circle No. A15.**



Vapor Degreasing and cool dip are combined in one automatic operation by a new type vapor degreaser. The unit operates on Phillips' Rotomatic principle which permits a pre-determined and accurately controlled degreasing time-cycle. The cool dip rinse washes off chips and other insolubles. The units range in size from 1800 lbs to 4000 lbs/hr. Phillips Mfg. Co., 3445 W. Touhy Ave., Chicago 45, or — **Circle Inform-A-Gram No. A16.**

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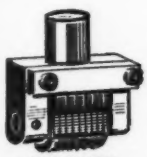
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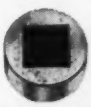

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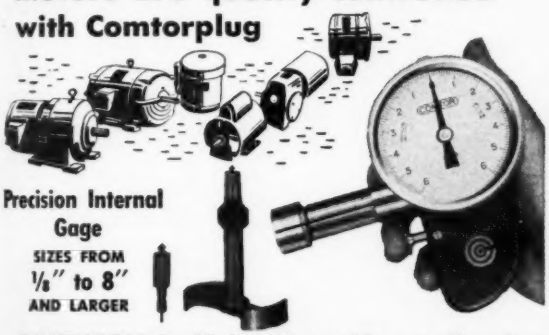

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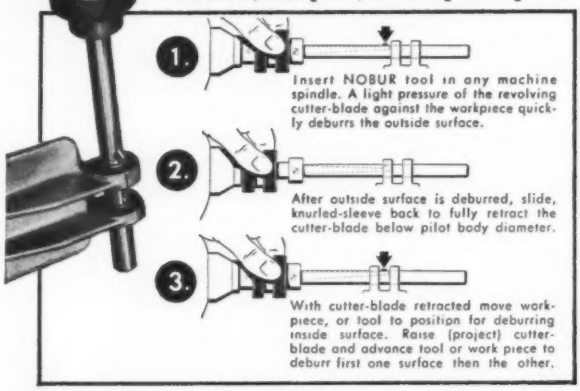
No more hand-finishing methods for those hard-to-get-at inner surfaces on multi-wall parts. The NOBUR Tool with its double edge cutting blade does the job in seconds . . . all by *machine operation.* Can be used by anyone, with complete safety, on your own lathe, drill press, etc. Simple to operate.



1. Insert NOBUR tool in any machine spindle. A light pressure of the revolving cutter-blade against the workpiece quickly deburrs the outside surface.
2. After outside surface is deburred, slide, knurled-sleeve back to fully retract the cutter-blade below pilot body diameter.
3. With cutter-blade retracted move workpiece, or tool to position for deburring inside surface. Raise (project) cutter-blade and advance tool or work piece to deburr first one surface then the other.

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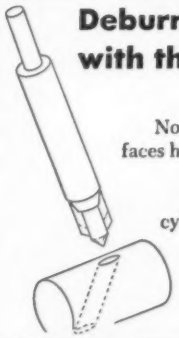

Deburring Elliptical Holes with the NEW! ELLIPTI-BURR TOOL

Now . . . deburr openly accessible hole faces having an irregular surface like those developed when holes are drilled angularly or when drilled through cylindrical bodies. This revolutionary tool is self-piloting with a two-lipped cutter that automatically follows the hole surface geometry. Write for full data.

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NO/BUR TOOLS NOBUR MANUFACTURING CO.
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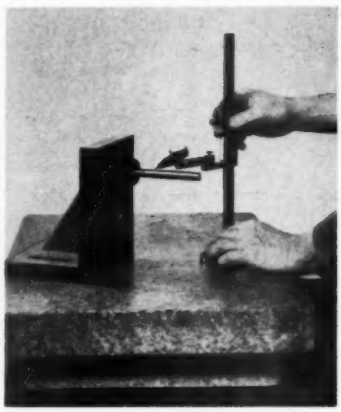
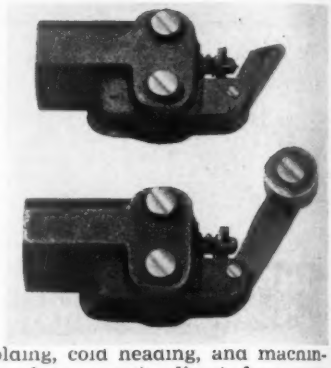
CIRCLE INFORM-A-GRAM KEY NO. 1981

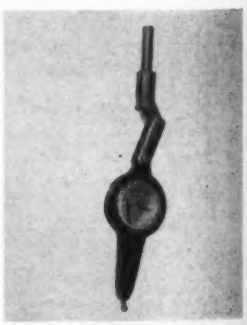


The Angle of Deviation from true horizontal or vertical can be quickly proved on most movable or mounted fixtures with a new low-cost precision checking device, the Magnacheck. This instrument assures more positive inspection of angle plates, angle bars, dies, and tools, in any position. Magna-Lock, Inc., 284 Maple St., Big Rapids, Mich., or—**Circle No. A17.**

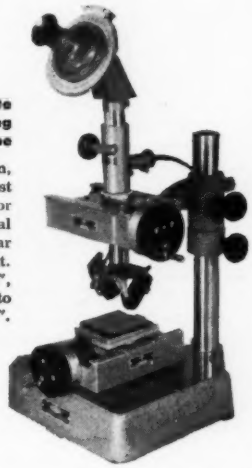


Especially Designed for High-Speed Automation Applications are these improved 2-way air valves. They are used for automatically ejecting stampings from punch presses and kick presses and for providing an automatic air blast for removing chips, dust, and shavings, in connection with drill press, plastic molding, cold heading, and machining operations. The valves operate direct from any compressed air line without the use of a filter. W. I. Martin and Co., 224 S. Michigan Ave., Chicago 4, or — **Circle Inform-A-Gram No. A18.**

Drill, Bore, Tap, or Ream Up to 12 Holes in one stroke in an area up to 18" dia with "Top-flite" drill heads. Instead of adjustable arms, they feature interchangeable cluster plates jig-bored to customer requirements which reduces setup time and insures correct work without rejects. Johnson Drill Head Co., 23rd Ave. and 20th St., Rockford, Ill., or—**Circle No. A19.**



A New Surface Test Indicator is adaptable for jig bore and jig grinding setup but can be used for all tool room or production work by using holding adapters. Indicator Model 75X has a double face and reads both sides. The universal swivel which holds the indicator, permits adjusting it into any position within a range of 0.150" to 6". Superior Indicator Co., P.O. Box 734, Rochester 3, N. Y., or — **Circle No. A20.**



Coordinate Measuring Microscope

High precision, low cost instrument for 2-dimensional linear measurement. Range 2" x 2", reading to 0.0001".

Cut rejects, speed production

Fast, reliable readings to 0.0001" with Gaertner measuring microscopes

Precise, versatile, easy-to-use Gaertner measuring microscopes assure positive, direct measurement of precision parts. You see clear, sharply-defined images. No physical contact to distort or injure object being measured. Enjoy new production savings with Gaertner optical instrumentation. Write for complete data on the Gaertner line of industrial microscopes.

Toolmakers' Microscope

Ultimate in measuring microscopes. Range 2" x 4", reading to 0.0001", angular measurement to 1 minute.

Micrometer Slide Comparator

Reliable, low cost instrument for linear measurement. Ranges up to 4", reading to 0.0001" or 0.00005".

Filar Micrometer Microscope

High quality, low cost instrument for extremely precise measurements. Range 0.08", reading to 0.00002".

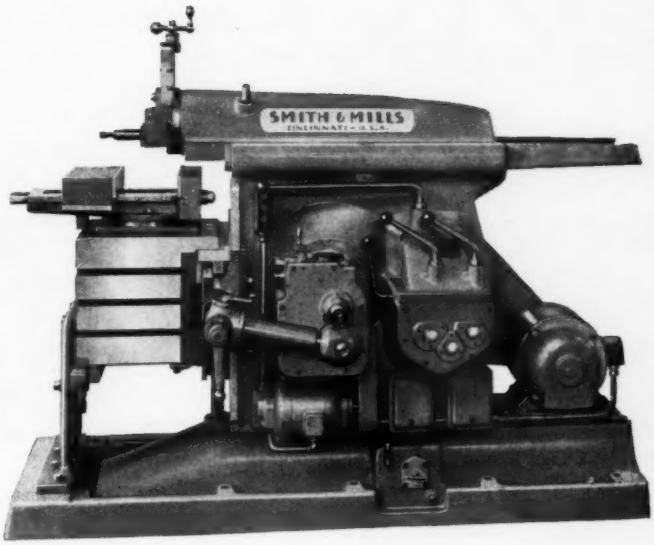
Write for Bulletin 161-54 showing applications, models, specifications.

The Gaertner Scientific Corporation

1242 Wrightwood Ave., Chicago 14, Ill.

Telephone: BUckingham 1-5335

CIRCLE INFORM-A-GRAM KEY NO. 1991



SMITH & MILLS SHAPERS—

for production and tool room

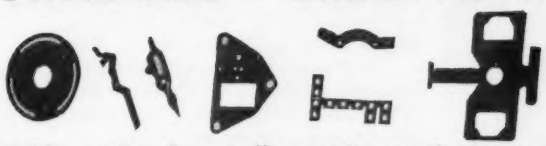
Compare Smith & Mills with any other shaper for versatility, speed, cutting power and precision performance. *Compare* and you'll *buy* Smith & Mills—famous for high quality shapers since 1888. Write or wire for prices, deliveries, repair parts or field service. Smith & Mills Shaper Division, Nebel Machine Tool Corp., 3401 Central Parkway, Cincinnati 25, Ohio.

Smith & Mills Shapers now available in Heavy Duty Models in 16", 20", 25", 28", 32" and 36" strokes, and Standard Duty Models in 20" and 24" strokes.

Smith AND Mills SHAPERS CINCINNATI

CIRCLE INFORM-A-GRAM KEY NO. 1992

STAMPINGS - - - SHORT RUNS



A dependable service for small quantity requirements for new developments and production up to 50,000 pieces. QUICK DELIVERY — ACCURACY — backed by 25 years' experience.

SMALL LOT STAMPING CO.

Linden 3-3700 "Dedicated to Short Runs" 1025 W. Blancke St. Linden, New Jersey

CIRCLE INFORM-A-GRAM KEY NO. 1993

Tough grinding jobs?

Check Vulcanaire high speed precision grinding heads!

Grinding circular slot using Vulcan's Rotary Table and Magnetic chuck.

Many seemingly impossible grinding problems have been solved by adapting Vulcanaire to standard machines or by using one of Vulcan's specially designed machines.

On Surface Grinders, merely remove wheel and guard, clamp vertical or horizontal adaptor to machine as illustrated. No belts necessary. For instance, Vulcanaire used in connection with Vulcan's Rotary Table for Surface Grinders permits the grinding of a circular slot.

Vertical adaptor for Surface Grinders. Grinding small slots

Adaptors are in stock to fit the spindle of Vertical Milling Machines for grinding contours, holes and slots.

On Internal Grinding Machines Vulcanaire's infinitely controlled speeds furnish the correct surface cutting speed resulting in faster production and micro finish. The adaptor sleeve fits into present housing.

Applied to Jig Boring Machines, Vulcanaire is liked by leading precision manufacturers because its accuracy is guaranteed, producing Vulcanaire jig grinding of large and small parts.

Horizontal application. Grinding a shoulder Punch.

Send us a blue print on your toughest grinding problem. Recommendations and sketches will be returned to you — no obligation.

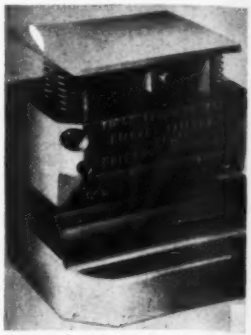
Major Vulcan Services

Engineering, Processing, Designing and Building... Special Tools... Dies ... Special Machines ... Vulcamatic Transfer Machines ... Automation ... including the Vulcan Hydraulics that Form, Pierce, Assemble and size. ... Vulcanaire Jig Grinders ... Motorized Rotary Tables ... Plastic Tooling.

VULCAN TOOL CO.

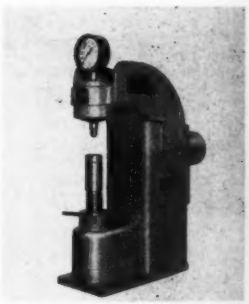
741 LORAIN AVE. • DAYTON, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 2001



Emboss Part Numbers and Letters at the same time hole-punching and notching operations are performed in the workpiece with Unimark part number units. Having the same shut and die heights as Unipunch hole-punching and notching units, Unimark units can be used with any combination of such units in the same setup on t-slotted plates, templates, or rails in presses and press brakes. With the removable block in front of the holder, the numbers and letters can be changed without removing the entire unit from the setup. Punch Products Corp., 3800 Highland Ave., Niagara Falls, or — **Circle Inform-A-Gram No. A21.**

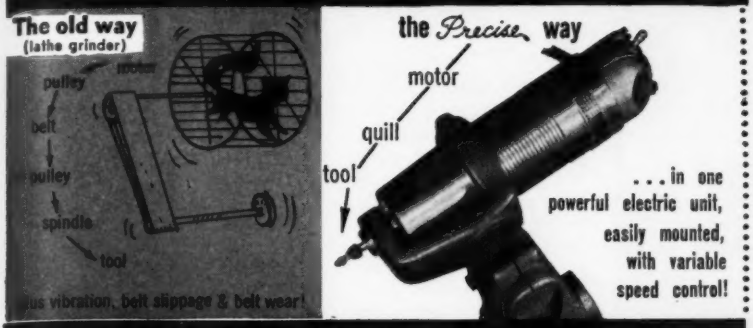
A Small Pneumatic Impact Machine has been developed for staking, crimping, riveting, force-assembling, and impression marking operations. Model 150-VS is similar to Model 200-VS except that it is smaller with about half the maximum impact capacity. It operates on constant air pressure with impact regulated by adjustment of hammer movement and is brought in contact with the work by a foot-pedal-operated mechanical traverse. Heidrich-Nourse Co., 631 E. 3rd St., Los Angeles 13, or— **Circle No. A22.**



This Bench-Type Brinell Hardness Tester combines economy with dependable accuracy. Model L, a motor-operated hydraulic machine, features a 3/4" stroke of the Brinell ball penetrator to eliminate anvil height adjustments and finger-tip load application. Steel City Testing Machines, Inc., 8817 Lyndon Ave., Detroit 38, or — **Circle No. A23.**

The Micro-Fog Lubro-Control Unit automatically creates a finely divided air-borne oil fog which can be uniformly distributed through complex piping systems to multiple lubrication points. A single unit can lubricate up to 1000 bearing-inches. C. A. Norgren Co., 3499 S. Elati, Englewood, Colo., or — **Circle No. A24.**

Take the direct approach to versatile tooling!



REPLACE OLD-FASHIONED LATHE GRINDERS WITH PRECISE POWER QUILLS!

Power Quill is a new name for a new tool that outperforms and outlasts lathe grinders, and saves fortunes through increased tooling versatility! Precise Super 60 Power Quills are unlimited in application, can be used on any machine and mounted in any position to mill, grind, finish, or micro-mill any material with abrasive wheels and tungsten carbide tools. And look at these exclusive Power Quill features:

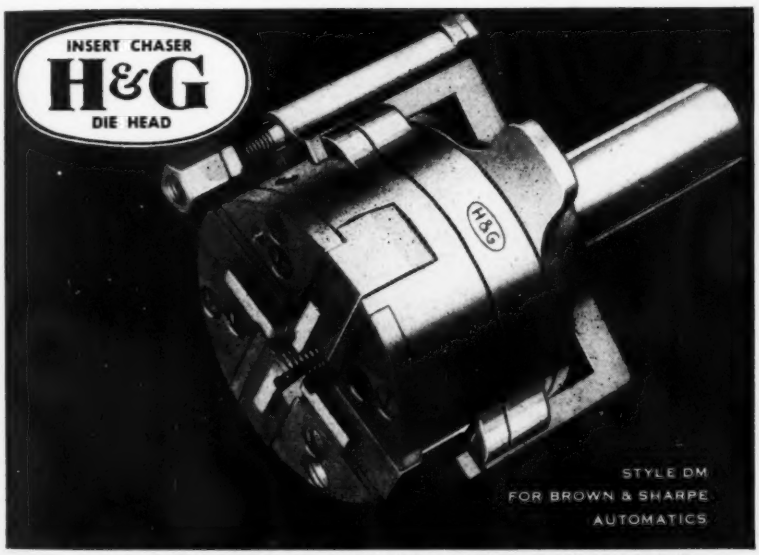
OPERATE AT SPEEDS UP TO 45,000 RPM, DEVELOP FULL ⅛ H.P.
CAN FINISH TO 5 MICRO INCHES AND .0001" TOLERANCES ON PRODUCTION MILLING AND GRINDING WITH CARBIDE TOOLS.
MOTOR AND SPINDLE ARE IN ONE COMPACT, DIRECT-LINE, SOLID STEEL PACKAGE WITH GREATER SPEED (45,000 RPM) TORQUE, ACCURACY, AND RIGIDITY.
REMOVE METAL FASTER, BETTER SURFACE FINISHES, INCREASE TOOL LIFE.
MOUNT IN ANY POSITION, ON ANY MACHINE, WITH PRECISE MOUNTS — FAST!

Attach this ad to your letterhead for FREE demonstration or literature!

PRECISE PRODUCTS CORP.
1341 CLARK STREET, RACINE, WISC.
Quality and precision since 1882
Grinder-Millers - Power Quills - High RPM Milling Machines - Mounts and Accessories - Rotary Tools

Precise

CIRCLE INFORM-A-GRAM KEY NO. 2011



STYLE AND SIZES FOR ALL MACHINES ON WHICH THREADS ARE CUT

On Brown and Sharpe, and other automatics.

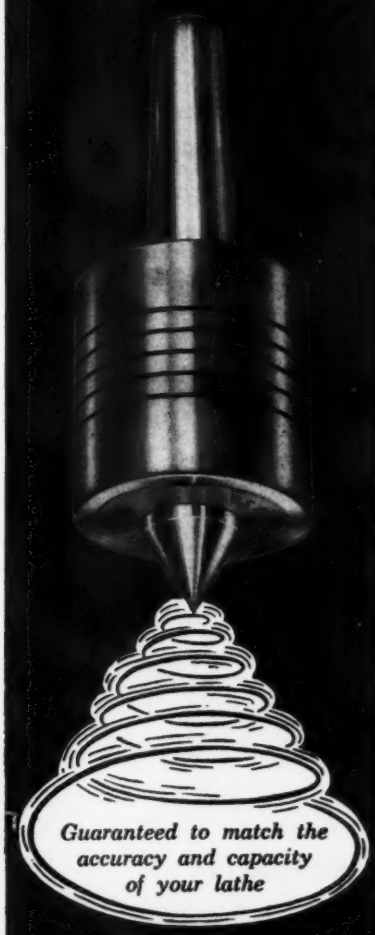
INSERT CHASERS SAVE UP TO 33%

Insert chasers are like safety razor blades: they cost so little that you can throw them away when dull. Or, for utmost economy, you can resharpen them over and over again. Only a flash grind is required. For less than $40 you get a dozen sets of ⅜–16 insert chasers, each set ground ready to go. You will be amazed at the quantity of threads they will cut, even to Class 3 specifications, with a minimum of downtime.
FREE: "Unified and American Screw Thread Digest"

THE EASTERN MACHINE SCREW CORPORATION 29-49 Barclay St., New Haven, Conn.

CIRCLE INFORM-A-GRAM KEY NO. 2012

Specify IDEAL LIVE CENTERS



Widest range of models, load capacities and tapers for every job!

ORDER FROM YOUR IDEAL DISTRIBUTOR OR MAIL COUPON

IDEAL

IDEAL INDUSTRIES, Inc.
1334 Park Ave., Sycamore, Illinois

Kindly send us data on Ideal's complete line of LIVE CENTERS.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

CANADIAN DISTRIB'R: Irving Smith, Ltd., Montreal

CIRCLE INFORM-A-GRAM KEY NO. 2013

Em-re PRECISION DIAL INDICATORS

SIMPLE, UNIT CONSTRUCTION

The new "Em-re" represents the first real advance in indicator design in decades. The case and gear assemblies are joined to form a rigid unit with a minimum of parts. The design is so simple that anyone with a small screw driver can assemble them. "Em-re" indicators have only 31 parts. What's more . . . 25 of the parts are common to each model. Available in 24 models in 6 ranges from .025" to .250" with graduations in .00005", .0001", .00025", .0005" and .001".

Write today for Bulletin 455-E describing the many remarkable features of this new line of indicators.

*Well within A.G.D. accuracy specifications.

PETZ-EMERY INC.
PLEASANT VALLEY, NEW YORK

CIRCLE INFORM-A-GRAM KEY NO. 2021

AT AN ANGLE — IT FILES

USED STRAIGHT — IT FINISHES

the Reciprofiler

IT'S THE NEW "3-WAY" TOOL by —

- Rotates and Reciprocates
- Non-Scratching movement
- 1 to 15,000 R.P.M.— stroke 0 to 3/8"
- Files, hones, saws, laps, polishes, chafes, grinds, mills, engraves, etc.
- TRADE NAME—Pats. Pend.

Nord Corporation
20 SPRUCE STREET
NUTLEY, NEW JERSEY

CIRCLE INFORM-A-GRAM KEY NO. 2022

HAND KNOBS

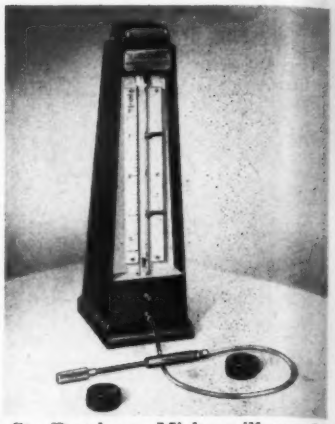
6 SIZES
CAST IRON

Tapped, Reamed or Blank.
Hex-shaped hub for extra tightening.

Write for catalog

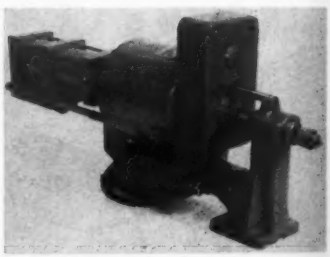
TIETZMANN TOOL CORPORATION
Dept. HK-2 • Englewood, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 2023



Finer Accuracy and ease of operation are provided by this new column-type air gaging instrument. The "Dearbornaire" instrument featuring a higher rated pressure system, is available as a single or multiple column unit in standard amplifications of 1250 to 1, 2500 to 1, and 5000 to 1, or any combination thereof. Air Gage Div'n, Dearborn Gage Co., 22038 Beech St., Dearborn, Mich., will supply a catalog with further details, or —
Circle Inform-A-Gram No. A25.

An All-Purpose Molded Plastic Handle for machine tools, dies and fixtures, etc. has been developed by The Chicago Screw Co., Div'n of Standard Screw Co., 2701 Washington Blvd., Bellwood, Ill. It has a sturdy steel core for tight fit and fast, easy assembly. It will withstand temperature extremes and severe shocks.
Circle No. A26.



Positive Depth Stop, proper rate of feed, and rapid advance to the work are features of Model 113 automatic drilling unit with ¼" chuck capacity. It has an electric motor driven spindle and hydraulically controlled air operated quill feed. Model 113 completes the line of automatic drilling units produced by The Electro-Mechano Co., 261 E. Erie St., Milwaukee.
Circle Inform-A-Gram No. A27.

Rugged Durability is combined with accuracy in a new-type torque limiting socket wrench. The completely automatic Jotru wrench has been developed for any type of assembly or construction operation where nuts or bolts require correct and uniform tightening. It permits a maximum torque variation of only ±2% under actual operating conditions. JoLine Tools, Inc., 8442 Otis St., South Gate, Calif., or —
Circle No. A28.

. . THE *Precision* BENCH TYPE PROTRACTOR

MANY TIMES FASTER THAN ANY OTHER KNOWN METHOD

NEW . . . FAST . . . VERSATILE

It's the modern method of checking your single-point tools. Check cutting angles, side and front rakes and clearance angles ALL ON ONE INSTRUMENT. Will accurately check and project any angle just as fast as the tool can be moved from one angle to another. It's self-aligning — only four moving parts in the complete machine.

Has a capacity for checking cutting angles on tools up to 2¼" high; rake and clearance angles on tools up to 1¾" high. Top rakes may be checked on any angle from the cutting edge. Works equally well on right or left hand tools. All checking is done by using only one side of the tool shank, which eliminates accumulative error. Surfaces subject to wear are carbide tipped.

Many of the leading and most progressive plants in the country have found this instrument a very worthwhile addition to their time-saving measuring equipment. No doubt you will too. Write for descriptive literature.

10 DAYS TRIAL!

ASK ABOUT OUR 10 DAY ON-THE-JOB TRIAL

KP NATIONAL SALES · 1036 TERRACE ST. MUSKEGON, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 2031

Powered by the press ram... independent of the die

2 SIZES Cuts steel up to 1/16" thick

3" WIDE $69 **6" WIDE $95**

Guaranteed — money back if not 100% satisfied

New LOW prices on the JACO AUTOMATIC STOCK REEL

WRITE FOR FULL DETAILS TODAY!

Dealer Inquiries Invited

JACO DEVICES, INC.

96 HIGH STREET • HINGHAM, MASS.

CIRCLE INFORM-A-GRAM KEY NO. 2032

"ADJUSTABLE STROKE" MIDGET

***Air-Clamp*®**

CYLINDER

®TRADEMARK

Now—put pressure where it's wanted instantly and cheaply, with Mead's powerful new midget air cylinders (1" bore, single-acting, spring return—horizontal and vertical). Stroke is adjustable. Cut costs—use 'em singly or in groups to move, hold, press or eject small work pieces; to close and open large jigs, forms, fixtures. They'll replace human fingers and mechanical clamps in countless routine jobs.

Catalog Free!

Write for new fact-and-picture-packed Air Power Catalog—or ask your nearest Mead Man!

MEAD SPECIALTIES COMPANY

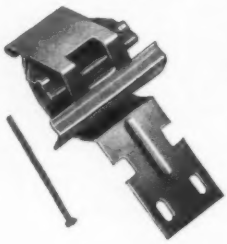
4114 N. Knox Ave., DEPT. HA-56 · CHICAGO 41, ILLINOIS

PATHFINDER IN AIR POWER AUTOMATION

CIRCLE INFORM-A-GRAM KEY NO. 2033

THE ANSWER to some difficult RIVETING PROBLEMS

For Example:



The long pin in this hinge assembly is ⅜" x 2½" and was being distorted and excessively peined. On the HILL RIVETER, with controlled time cycle and adjustable impact, a perfect job is done every time in 2 seconds at 15 psi.

This air-operated riveting machine produces *accurately controllable* results that cannot be obtained on ordinary machines. It is fast and efficient, extremely versatile, and easily adaptable for either short-run or mass-production jobs. For regular solid riveting, it is unbeatable; for difficult problems, it is *The* Answer.

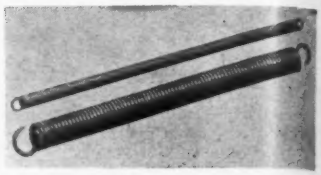
THE HILL PNEUMATIC RIVETING MACHINE

Essentially, the machine consists of a revolving, air operated, reciprocating hammer, working against an anvil which is adjustable in a rigid bracket. Many important details have been worked out for convenience, for neat appearance, for long life, and for superior performance. *For all details, and complete specifications, write for free bulletin: "High Speed Production Riveting."*

HILL MACHINE COMPANY

1301 EDDY AVE., ROCKFORD, ILLINOIS

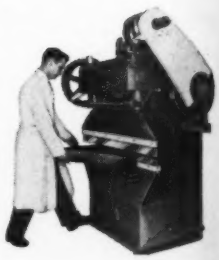
CIRCLE INFORM-A-GRAM KEY NO. 2041

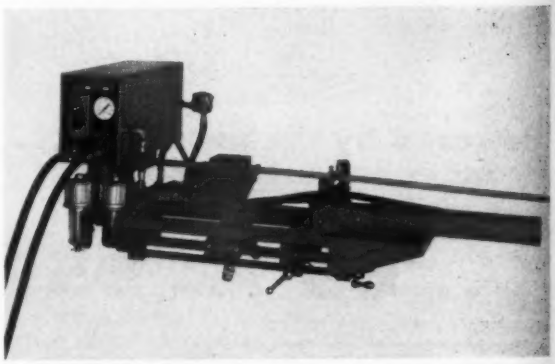


Eliminate the Process of Winding Springs with an assortment of 29 extension springs ranging from ⅛" to 1" dia. Made of music wire, each is 11" long with loops or hooks on each end. A spring is selected in the size wanted and cut to the desired length. Reid Tool Supply Co., Muskegon Heights, Mich., or — **Circle Inform-A-Gram No. A29.**

Apply Oil to Stock on metal forming, stamping, and drawing operations with a low-priced, forced feed stock oiler. The Stocklube System is designed for long or short runs. It confines oil within the housing and the metal is not only lubricated but also cleaned. Graymills Corp., 3705 N. Lincoln Ave., Chicago 13, or — **Circle No. A30.**

A 24-Ton Capacity Connecticut Press Brake has been announced by W. Whitney Stueck, Inc., Old Saybrook, Conn. Model 24-A-412 will bend 4' of 12 ga mild steel over a ⅞" die. It has all steel gearing, front-operated variable speed drive, 1 hp motor, and front-operated back gage. Its stroke is 2" and the bed and ram are 48" long. **No. A31.**





The Rated Carriage Speed on an improved micro-air power press feed has been increased from 1 ft/sec to 1½ ft/sec at 100 psi. The machine features centrally located controls and spring loaded grease cups on longer bushings to give smoother performance. A lead screw permits adjustment of feed length while the machine is in operation. Nadel Tool & Mfg. Co., Inc., 20 Warren St., New York, 7, or — **Circle Inform-A-Gram No. A32.**

THEN USE THE 3 COMET "TIPS"

MADE OF HIGH SPEED or CARBIDE
FOR HOLES FROM 1/16" UPWARD
17 DIFFERENT SIZES

BORING TOOL
- FAST PERFORMANCE
- ECONOMY IN PRODUCTION
- EFFICIENT IN RESULTS

Cutting Edges are lapped for better "Bores" and Faster Feeds.

FACING TOOL
- CONSTANT CLEARANCE • EASY RESHARPENING
- CONSTANT SHAPE OF CROSS SECTION
- CONVENIENT TO USE • LONG LIFE

INTERNAL THREADING TOOL
- CONSTANT SHAPE AND CLEARANCE
- EASY RESHARPENING • LONG LIFE

WRITE FOR COMPLETE DATA

COMET Tool Co.

738-T BROADWAY, NEW YORK 3, NEW YORK

CIRCLE INFORM-A-GRAM KEY NO. 2051

AIR POWERED DRILL PRESS FEEDS

• Quickly installed • Eight models • Standard or heavy-duty service • No tapping head required for tapping • Instant reversal • Write for Bulletin No. 22.

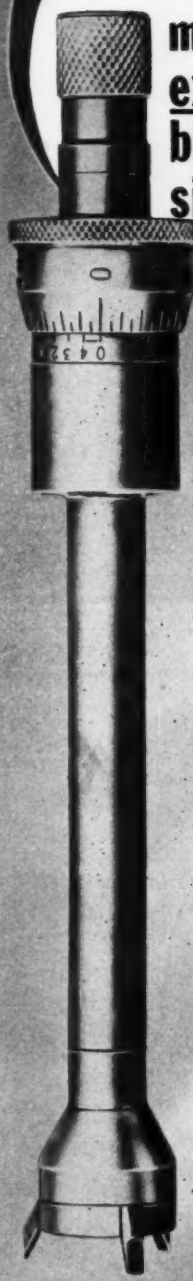
MODELS	*Standard*	*Heavy Duty*
Mechanical-Drilling	25M7A	40M12A
Electrical-Drilling	25E7A	40E12A
Drilling-Tapping	25ED7A	40ED12A
Drilling-Dwell	25EB7A	40EB12A

BECKETT-HARCUM COMPANY INC.

1096 Wayne Road Wilmington, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 2052

Etalon INGAGE
measures the exact bore or blind hole size



Reading: .0001"
Sizes: 3/16" to 1.6"

This unique new precision measuring instrument will take measurements of blind holes. No masters or setting rings needed — measures *directly* — by .0001".

Automatically aligns in holes, rectangular contact points guarantee extreme accuracy even when fully extended. Immediately detects out of round holes. Extensions facilitate accurate measurements of holes up to 6 feet in depth. Hardened contact points exert only 11 oz. measuring pressure —will not damage even fragile work.

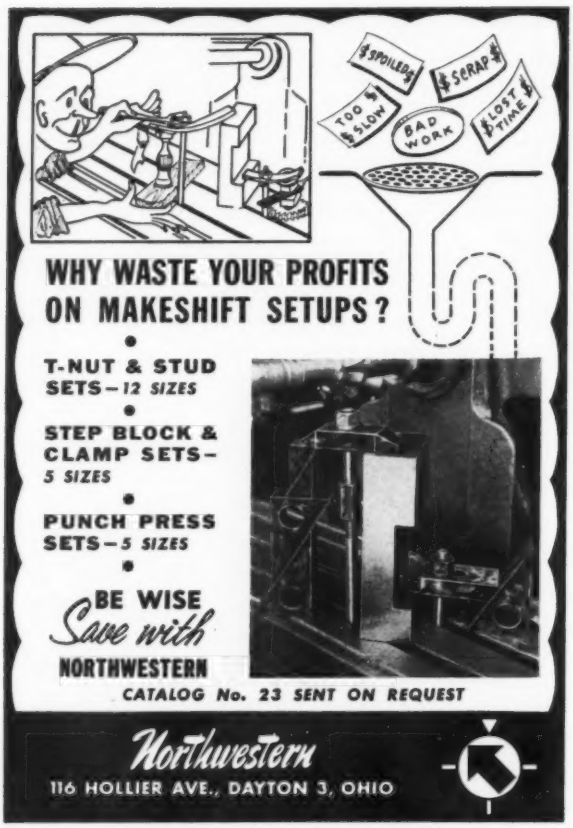
Exceptionally easy to read, deep clean-cut graduations laid out on a large diameter thimble. Dull chrome plated finish. Furnished in English or Metric graduations, individually or in sets.

WRITE FOR CATALOG on complete line of precision measuring instruments: VERNIER CALIPERS—MICROMETERS —DIAL INDICATORS

ALINA

ALINA CORPORATION
401 Broadway, New York 13, N.Y.

CIRCLE INFORM-A-GRAM KEY NO. 2053

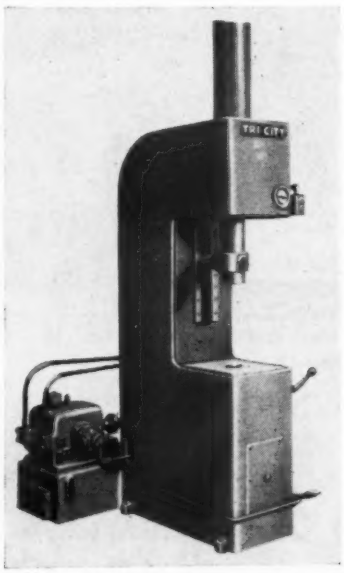

$ SPOILED $
$ SCRAP $
TOO $ SLOW
BAD WORK
$ LOST $ TIME
WHY WASTE YOUR PROFITS ON MAKESHIFT SETUPS?
T-NUT & STUD SETS – 12 SIZES
STEP BLOCK & CLAMP SETS – 5 SIZES
PUNCH PRESS SETS – 5 SIZES
BE WISE Save with NORTHWESTERN
CATALOG No. 23 SENT ON REQUEST
Northwestern
116 HOLLIER AVE., DAYTON 3, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 2061

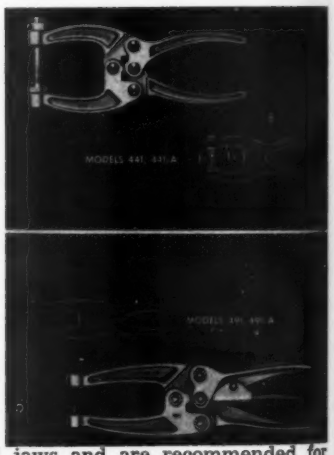
BLADES
ROLLS
WORLD'S HARDEST METAL
● New, improved TALIDE METAL is uniform in quality—gives top performance on ALL cutting, drawing and wear-resistant applications. Write for Catalog 56-G. METAL CARBIDES CORP., Youngstown 12, Ohio.
TOOLS
DIES
BAR STOCK
METAL CARBIDES CORPORATION
TALIDE
YOUNGSTOWN 12, OHIO
HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • CERMETS • HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

CIRCLE INFORM-A-GRAM KEY NO. 2062

Machine 2 Surfaces Simultaneously with one fixture in one setup. The Nichols twin mill features independent adjustment of milling heads in 3 directions, 15 spindle speeds from 55 to 2050 rpm, and solenoid - controlled automatic pneumatic table feed. This machine can be used on long or short run jobs with minimum set-up time. Nichols-Morris Corp., 76 Mamaroneck Ave., P.O. Box 430, White Plains, N. Y., or — **Circle No. A33.**



Accurate and Sensitive Control of ram speed, force, travel, and direction of movement through a hand lever or foot pedal is possible with a fluid power gooseneck press. This press will speed up production on stamping, broaching, assembling, straightening, and general pressing operations. It has long adjustable ram travel and a deep working throat. Tri-City Tool & Machinery Corp., 513—31st Ave., Rock Island, Ill., or — **Circle No. A34.**



Two All-Aluminum Models are included in 4 new De-Sta-Co portable toggle clamps announced by Detroit Stamping Co., Detroit 3. Models 441-A and 491-A are identical to Models 441 and 491 except that they are made of forged alloy aluminum and 441 and 491 are of forged steel construction. Heavy-duty Models 491-A and 491, measuring 10" long, feature narrow deep-throated jaws and are recommended for working in confined areas, for holding sheet metal, and for laminations. Light-duty Models 441-A and 441 which are 6" long, have smaller, but wider jaws. **Circle Inform-A-Gram No. A35.**

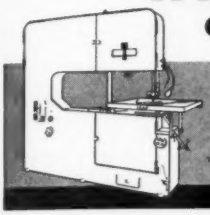
FRICTION SAWING with Tannewitz HIGH SPEED BAND SAWS

FASTEST, BEST MEANS OF CUTTING METALS

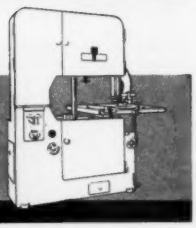
If you are not familiar with the advantages of friction sawing with these machines, by all means drop us a line asking for "Friction Sawing Data." You can save many times the cost of a Tannewitz High Speed Band Saw and greatly expedite production by using it to cut sheets of both hard and soft steel, formed or flat, trimming malleable and steel castings, cutting armor plate or many other materials. Write NOW!

THE TANNEWITZ WORKS

GRAND RAPIDS, MICHIGAN ☎ **GL-6-1729**



TANNEWITZ DI-SAWS — 24", 36", 48", 60" CAPACITIES
for CONTOUR SAWING, FILING, POLISHING
The smoothest, fastest, most trouble-free Di-Saws on the market. Write for bulletin.



CIRCLE INFORM-A-GRAM KEY NO. 2071

PARTS INTERCHANGEABILITY ASSURED WITH ANCHOR BUSHING DRILL TEMPLATES

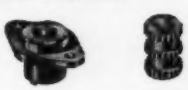
Hole alignment for interchangeable access panels is assured through use of inexpensive Anchor Bushing drill templates on the FJ-4 Fighter production line at North American Aviation's Columbus Division.

Made from thin sheet metal or laminate plastics, Anchor Bushing drill templates are readily formed to match curved or oddly shaped contours. Simple construction, combined with inexpensive Anchor Bushings, provides accurate drill tooling for low or high volume work at a cost well under comparable drill jigs or fixtures.

Write for the Anchor Bushing Catalog for sheet metal and laminate plastic tooling techniques, types and sizes of Anchor Bushings and price list.

A FEW TYPES OF ANCHOR BUSHINGS

STANDARD NUT PLATE
FOR SHEET METAL TEMPLATES



DIAMOND KNURLED
FOR LAMINATE PLASTIC TEMPLATES

hi-shear RIVET TOOL COMPANY

8924 BELLANCA AVENUE • LOS ANGELES 45 • CALIFORNIA

CIRCLE INFORM-A-GRAM KEY NO. 2072

HEAVY METAL • CERMETS • HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY
CIRCLE INFORM-A-GRAM KEY NO. 2062

Faster, Better, Less Expensive . . .

MARKING *with job designed*

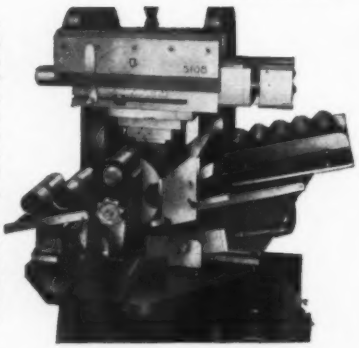
GEO. T. SCHMIDT

Production Marking Machines

The fully automatic, hydraulically - operated tube marker shown here was designed by GTS engineers for major automotive manufacturers.

The units roll a trademark and part number on 2500 to 3000 mild steel thin-walled tubes per hour — a speed that cuts cost per impression to the bone. Hydraulic control keeps all impressions clean, accurate, and of precisely the same depth.

Have a GTS Sales Engineer call on you, without obligation, to discuss how modern marking methods can save costs and speed production in your operation.



GEO. T. SCHMIDT, INC.
4112 Ravenswood Avenue
Chicago 13, Illinois

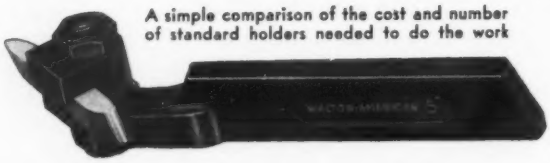
If It's Worth Making, It's Worth Marking

CIRCLE INFORM-A-GRAM KEY NO. 2081

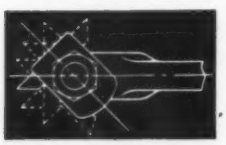
Walton-American

THE ONE "MULTI-POSITION" TOOL HOLDER REPLACING MANY!

A simple comparison of the cost and number of standard holders needed to do the work



of ONE Walton-American will quickly show you that this versatile Tool Holder is a money saver as well as a labor saver. The capacities of only four sizes range from 1/8" to 1/2".



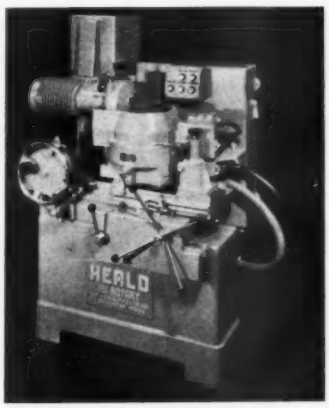
The exclusive design of the Walton-American swivel head holds the tool in any position, giving perfect grip on round or square tool bits or boring bars. Illustration shows eight most commonly used positions.

If you are seeking ways to reduce your tool costs, it will pay you to investigate Walton-American. Write for Data Folder No. 38. We offer a liberal FREE TRIAL.

The WALTON Company
HARTFORD 10, CONN.

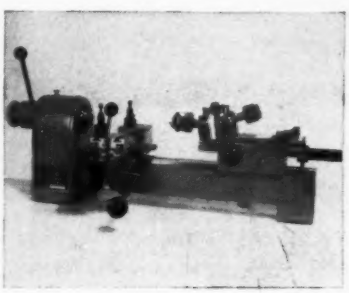
CIRCLE INFORM-A-GRAM KEY NO. 2082

Hold a Wide Variety of Shapes and save time in making special jigs, clamps, or chucks with a magnetic drill vise. The Bux magnetic vise will hold small, irregularly shaped parts for drilling, fix exactly the position of pieces to be drilled on a production basis, hold fabricated parts in position for assembling, etc. Buck Mfg. Co., 100 Roberts Rd., Los Gatos, Calif., or — **Circle No. A36.**



Small Part Grinding is performed by Model 161 rotary surface grinder. It has been specially designed for surface grinding small saws, slitters, gear cutters, gears, bearings, washers, and other rotatable parts. The 6" dia radial pole magnetic chuck can be positioned for flat, convex, or concave grinding up to 15°. The Heald Machine Co., Worcester 6, Mass., or — **Circle No. A37.**

More Than 100 Model Variations are provided by this compact, lightweight aluminum multi-purpose valve. Comet II can be adapted to power a welding gun, air-operated transfer mechanisms, air riveting, and testing fixtures. It completes a valve cycle within 0.033 sec. It measures 7¼" x 3½" x 3⅞". Ross Operating Valve Co., 120 E. Golden Gate Ave., Detroit 3, or — **Circle No. A38.**



A Runout of Less Than 0.0001" at the headstock, lever collet closer, and a 6-position turret having ⅝" holes for tools are features of a cabinet-mounted lathe. Model 750 is 24" long with a 22" bed length, and has a 5/16" capacity. F. W. Derbyshire, Waltham, Mass., or — **Circle A39.**

COOPER WEYMOUTH

VARIABLE SPEED

STOCK STRAIGHTENERS

Portable cabinet units in sizes 6" up to 24". Constant or variable speed drives with forward, reverse and cut-out switch. Five, seven or nine straightening rolls. Pinch rolls and all bottom straightening rolls power driven.

WRITE FOR DETAILS

COOPER WEYMOUTH INC.

277 NOBLE AVE., BRIDGEPORT 8, CONN.

CIRCLE INFORM-A-GRAM KEY NO. 2091

CUTTING THREADS?

CHASO'S chasers and self opening dieheads offer the fast economical way to do Production threading.

CHASO also manufactures chasers for most makes of dieheads thus offering a complete thread chaser service for whatever dieheads you have.

CHASO chasers are *guaranteed* to perform satisfactorily, and at a savings in your threading costs.

Write for complete catalog

When you think of chasers think of CHASO.

MANUFACTURING CHASERS FOR 25 YEARS

CHASO TOOL CO. INC.

PHONE 2210

BOX 268A NORTH BRANCH, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 2092

COMPLETE THE DIE-SET AT YOUR BENCH

Lacey Die-Set Machine

Here's a truly "one man" press. It operates with one hand. Handy for tool and press rooms, it permits the diemaker to complete a die-set at his bench . . . saves toolroom and handling costs. Ask today for full details.

Sole Distributors

MOORE SPECIAL TOOL CO., INC.

726 Union Avenue Bridgeport 7, Conn.

CIRCLE INFORM-A-GRAM KEY NO. 2093

BRYANT TRUE GRANITE SURFACE PLATES

ROCK OF AGES

Unequalled Wear Resistance!

All Bryant Surface Plates are manufactured from fine-grained *true quartz* granite. Their resistance to wear surpasses *all* other materials used as surface plates.

Patented "head of the grain" finishing process gives added assurance of retained accuracy through years of use.

Full range of sizes available from the same selected black-and-white true granite, in precision, standard and layout accuracies.

Convenient stands feature both utility and appearance.

Write for quotation, stating size and accuracy desired

BRYANT GAGE & SPINDLE DIVISION • Box 620-H, Springfield, Vermont

Internal Grinders • Boring Machines • Internal & External Thread Gages
Groove Gages • Granite Surface Plates • Magnetic Drum Memory Devices for Computing Systems

DIVISION OF BRYANT CHUCKING GRINDER COMPANY

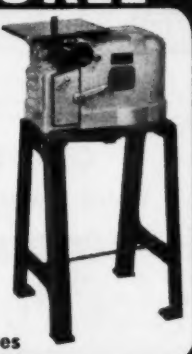
CIRCLE INFORM-A-GRAM KEY NO. 2094

Smoother Production! Higher Output! Lower Costs!

RICE-MILWAUKEE

DIE FILERS . . . for straight-line sharp corner filing, sawing and lapping.

This low cost precision-built unit performs all die making operations at savings up to 40%. Furnished complete with motor and two overarms. No extras to buy.



PROFILE GRINDERS

. . . for high speed Precision Grinding of Curved and Irregular Contours.

Standard features include 20,000 or 30,000 R.P.M., or a combination of these spindle speeds, ½ H.P. motor, Collet Chuck, Compound tilting table, built-in wheel dresser.

Write for Illustrated Bulletins and Prices

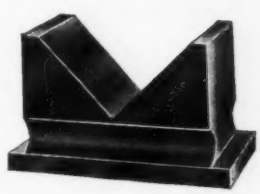
RICE PUMP & MACHINE COMPANY

228 PARK AVENUE BELGIUM WISCONSIN

CIRCLE INFORM-A-GRAM KEY NO. 2095

SEMI-PRECISION "V" BLOCKS

for all-around shop use



Sturdily designed for hard usage . . . Accurately machined from close-grain iron . . . Ideal for drill presses, milling machines, shapers and planers. Will test round shafting for straightness . . . Economically priced.

Write for descriptive bulletin.

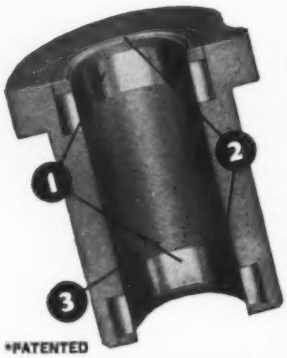
STOCK NO.	BASE	HEIGHT	THICKNESS	ACROSS TOP	CAP.	WT.	NET PRICE EA.
10	4½" x 3"	2⅝"	3"	3½"	2¾" dia.	6½ lbs.	$ 8.00
11	6½" x 4"	4"	4"	5½"	4¾" dia.	18 lbs.	$16.25

ACME TOOL COMPANY

71 WEST BROADWAY NEW YORK 7, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 2096

INCREASE PRODUCTION.. SAVE TIME & MONEY



*PATENTED

1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

For information and prices write for MEYCO Bushing Catalog No. 41

MEYCO

Carbide Inserted Bushings Are Doing It Daily!

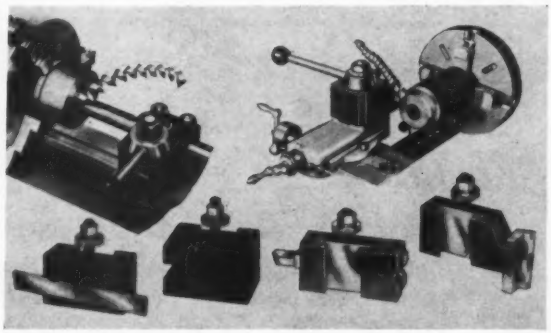
How? Like this: (1) Last longer . . . with a life—in most cases—as long as solid carbide bushings at prices that approach the price of steel bushings; (2) Increased life for your drill jigs and fixtures; (3) Increased life for your drills and reamers; (4) Accuracy maintained for a LONG PERIOD of time; (5) Less non-productive machine time, less lost man-hours, because bushings need not be changed as often; (6) Inspection time saved, because of greater accuracy for a longer time; and (7) Less waste due to spoilage, for the same reason. Don't pass up a good bet! Get the dope on MEYCO Carbide Inserted Drill Jig Bushings today!

ESTABLISHED 1866

W. F. MEYERS CO., INC., BEDFORD, INDIANA

CIRCLE INFORM-A-GRAM KEY NO. 2101

GET THE MAXIMUM from your lathes by using the ALORIS "Quick Change" patented TOOL POST and HOLDERS



Only a second to change tools for turning, facing, drilling, boring, threading, knurling, cutting off or any other operation.

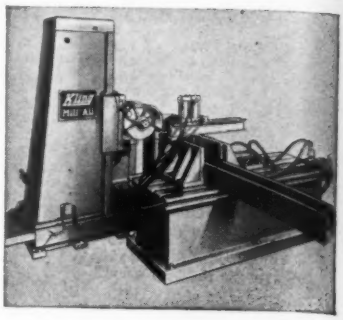
- Great Repetitive Accuracy
- Rugged Construction
- Tested and Recommended by Leading Lathe Manufacturers
- Greater Rigidity
- Saves 90% In Set-Up Time
- Unconditionally Guaranteed

Write for catalog and price list.

ALORIS TOOL CO., INC. 131-37 SANFORD AVENUE FLUSHING 55, N. Y.

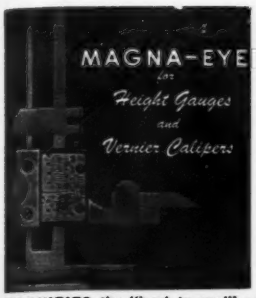
CIRCLE INFORM-A-GRAM KEY NO. 2102

Designed to Do a Wider Variety of Facing Jobs, faster and at lower cost, is a Mill-All beam and column mill. The machine will face steel and iron castings, forgings, weldments, and die blocks; and chamfer plates and bars. It can also be used for plate edging and can be adapted to mill aluminum and other ferrous materials. Metal removal rates are from 40 to 80 cu in/min. Kling Bros. Engineering Works, 1320 N. Kostner Ave., Chicago 51, or —**Circle No. A40.**



A Self-Contained Dust Collecting Unit is featured in this 12" or 14" heavy-duty grinder. The Grind Air-rester has the dust control system built inside its base, minimizing overall floor space. A motor-driven material handling fan operates simultaneously with the grinder motor. The Standard Electrical Tool Co., Mt. Hope and Sixth St., Cincinnati 4. **Circle No. A41.**

Speed Up Difficult Micro Hole Drilling down to 0.001" with the Micro-Drill with a magnetic chuck. The micrometer depth control provides a means for drilling blind holes to close tolerance. The multiple hole micro-drill shown has two-way table travel which eliminates setup time between holes and removes the need for high cost tooling to get the same movement. A single hole unit with stationary table is also available. The Dumore Co., Racine, Wisc., or — **Circle Inform-A-Gram No. A42.**



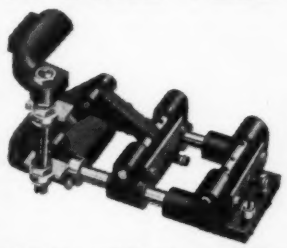
MAGNIFIES "HARD-TO-READ" VERNIER SCALES ON HEIGHT GAGES AND CALIPERS

MAGNIFIES the "hard to read" vernier scales on calipers and height gages. No more eye strain, guess work or hit or miss setting and reading. **LENS** is finest quality optical glass, specially designed and ground for the purpose with utmost optical skill. 4X magnification shows lines true and correct. In daily use in plants of Westinghouse, General Electric, General Motors, Chrysler, Packard, Ford, Boeing Aircraft, Bendix Aviation and many others engaged in defense work.
Made in 3 sizes to fit Starrett, Brown & Sharpe, Lufkin Tools, and others of similar design. 8 No. 100 for 6" Vernier Calipers; 8 No. 200 for 10"-12" Height Gages, also 10"-18"-24" Vernier Calipers; 8 No. 300 for most popular type 18" and 24" Height Gages and for 36"-48" 60" and 72" Calipers.
For Complete Information Write, Phone or Wire

STEBAR COMPANY
217 28th Ave. North Minneapolis 11, Minn.

CIRCLE INFORM-A-GRAM KEY NO. 2111

A SURE FEED



PRODUCTO AUTOMATIC "SUREFEED"

Your pressroom can produce more with this compact, durable hitch feed. Can be mounted right on die set to save you time. Direct linkage feeding affords greater accuracy. Comes in 2" and 3" sizes. Write for detailed bulletin on this cost-cutter.

THE PRODUCTO MACHINE CO.
970 Housatonic Avenue
Bridgeport 1, Connecticut

CIRCLE INFORM-A-GRAM KEY NO. 2112

Monarch Precision SHAPLANE Radius Tools

Patent Pending

Five Models for
LATHES, SHAPERS, PLANERS AND BORING MILLS.

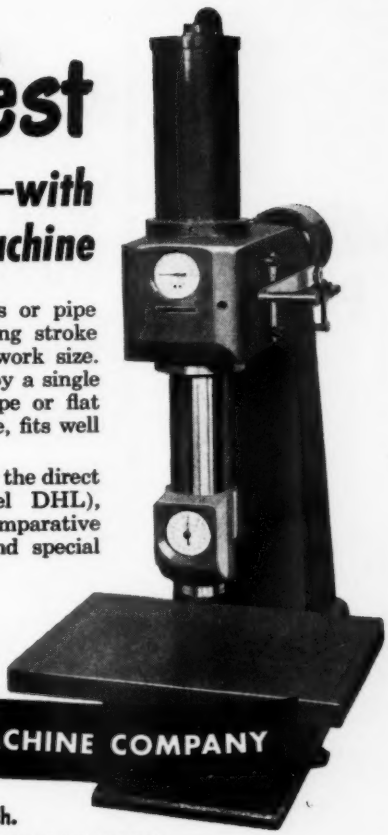
RANGE ½" TO 3" RADIUS (MODELS ALSO AVAILABLE FOR CONVEX CUTTING, AND CONCAVE RADII TO 6" ON PLANERS, ETC.)

C. B. TEETER
Tool Room Specialties
4470 Oakenwald Ave., Chicago 15, Ill.
Phone Drexel 3-3571

CIRCLE INFORM-A-GRAM KEY NO. 2113

Brinell Test

large pieces fast—with this long stroke machine



Large awkward castings, forgings or pipe are easily tested because the long stroke eliminates screw adjustment to work size. The hydraulic ram is controlled by a single lever. Large, stationary roller-type or flat table makes work handling simple, fits well into a conveyor line.

Choice of plain Brinell machine or the direct reading machine (shown, model DHL), where dial at end of ram gives comparative hardness immediately. Larger and special machines may also be had.

Write for more information on all our Brinell testing machines.

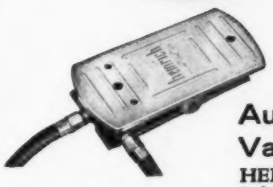
DETROIT TESTING MACHINE COMPANY

9386 Grinnell Ave., Detroit 13, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 2114

NEW HEINRICH SELF-CENTERING AIR VISE

Movement of jaws is mechanically synchronized within a tolerance of .001"



Furnished with Foot Treadle Valve, hoses and fittings.
Price, $139.50 complete.

Automatically Centers Parts Varying in Size

HEINRICH Self-Centering Air Vise has 4" wide vise jaws infinitely adjustable to 4⅛" opening. Maximum travel—⅜" each jaw; total of ¾". Grips with force 15 times air line pressure for each cylinder (3,000 lbs. at 100 psi). Used as a jig and fixture base, cuts tooling costs . . . boosts production. Write for FREE Catalog.

heinrich TOOLS INC., Dept. 136-E, Racine, Wis.

CIRCLE INFORM-A-GRAM KEY NO. 2115

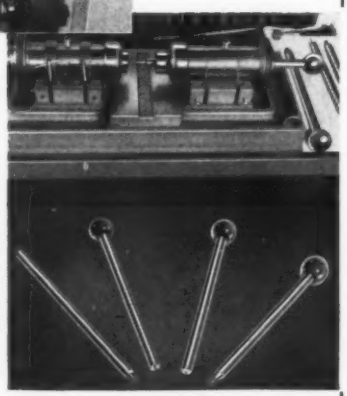
NOW POSSIBLE!

CONSECUTIVE OPERATIONS WITH MULTIPLE TOOLING -

Without removing workpiece from work spindle

JEDCO MICRO-DRILLING MACHINE

★



For Drilling Holes Parallel To A Cylindrical Axis

At last . . . a micro drilling machine with MULTIPLE TOOL QUILLS . . . allowing a series of operations — drilling, chamfering, reaming, etc. — to be done consecutively without need of removing workpiece from work spindle.

OR . . . with suitable attachments, another model can be used to drill holes on rectangular coordinates to an accuracy of plus or minus .0005.

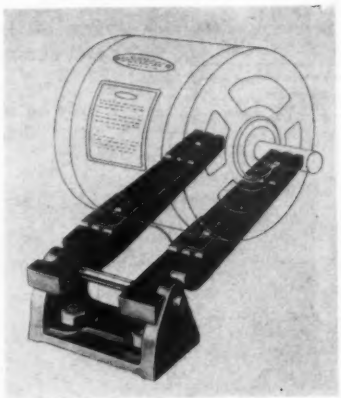
CONTACT US FOR YOUR PROBLEMS . . .

In small tools, minute drilling operations, Micro Drill Guides, automation engineering and building facilities.

MICRO DRILL GUIDE DIVISION JEDCO 3980 SUPERIOR AVENUE CINCINNATI 36, OHIO

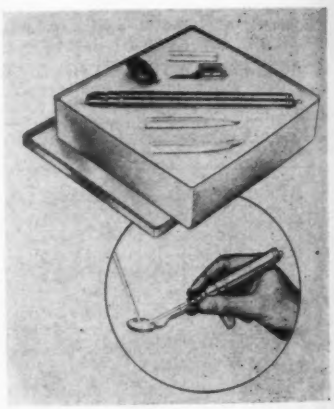
CIRCLE INFORM-A-GRAM KEY NO. 2121

Rough and Finish Grinding of Various Slots in soft and hard parts is performed by a new type slot grinding machine. Finish slots are ground to low micro-inch surface finishes. The machine features include automatic wheel diameter compensation and a two speed motor for either roughing or finishing. Planet Products Corp., Cincinnati 27, or — **Circle No. A43.**



Compensation for Belt Stress is a feature of this economical motor base for V-belt drives. The Auto-Tension motor base maintains exact belt tension for all load conditions. Belts can be changed without disturbing the mounting. It is designed for use with horizontally positioned drives. Lovejoy Flexible Coupling Co., 4819 W. Lake St., Chicago 44. **Circle No. A44.**

This Conduct-A-Lite Instrument Set operates on the principle of light conduction through 5/16" lengths of lucite. It is designed to illuminate dark areas in inaccessible places, around corners, and for any type of localized lighting. The instrument is used for the lining up of dies, examination of housings, etc. Foster Supply Co., 6122 Milwaukee Ave., Chicago, or — **Circle No. A45.**



A Small Black Granite Surface Plate for bench use has been introduced by Collins Microflat Co., 2326 E. 8th St., Los Angeles. The Toolmakers Flat is 8" x 12" x 2", weighs 15 lbs, and has an overall accuracy of 0.0002". This small plate will be of value to tool and die makers, benchmen, machinists, and in small plants and model shops, etc. **Circle Inform-A-Gram No. A46.**

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TO WORK WHERE IT'S FUN TO LIVE

Can You Qualify?

- Electronics Technician or Engineer
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- Physicist
- Draftsman
- Precision Production Machinist
- Precision Machine Operator
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Here is what you should do:

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✓ Send a summary of your qualifications and experience. State when you are available.

✓ Do not come to Phoenix without first writing. Job opportunities are mainly restricted to specialists listed here. If your summary qualifies you for consideration you will be contacted by mail, phone or in person for further interview.

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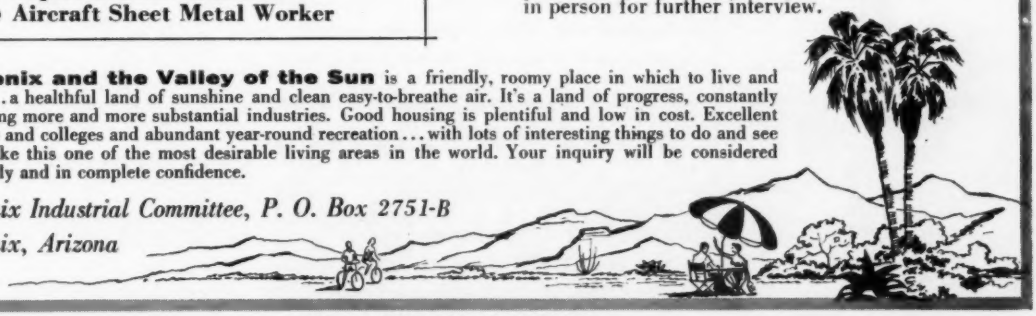

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TURNING
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SIX SIZES AVAILABLE

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*A BORING HEAD THAT WON'T FACE IS NOT COMPLETE

Model "D"

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Muncie, Indiana

COMBINED BORING & FACING TOOL HEADS
Chandler-Duplex

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A New Concept in Optical Comparator Design...

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- *Erect Image*
- *Eye Level Screen*
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An Entirely New Model Optical Comparator
Designed for 100% Production Inspection
ACCURATE - FAST - INEXPENSIVE
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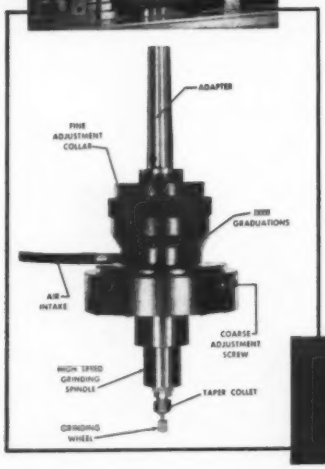
Grind Precision Holes *without* STOPPING the SPINDLE

You can save a lot of time in precision grinding with Grind-A-Matic, the new air-driven head. Unlike other comparable units, radial feed may be increased in increments of .0001" as grinding proceeds. You don't have to stop the spindle every time. Just turn the adjustment collar.

Used as a tool in any jig bore, boring mill, lathe or vertical mill, it gives you high production with the precision of a jig grinder.

Grind-A-Matic grinds holes ⅛ to 2½ inches in diameter with standard equipment. An auxiliary mounting arm increases this range to 4 inches.



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PERFEX

PERFEX GAGE & TOOL CO.

123 AVERY ST. • MT. CLEMENS, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 2141

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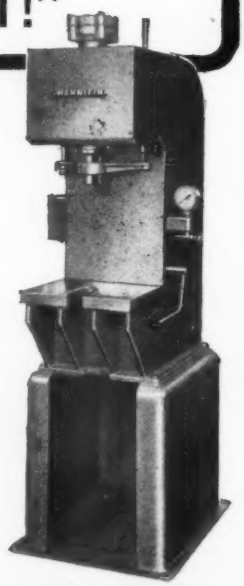


That's the price of this 5-Ton HANNIFIN Press*

A lot of production men have made such comments about this versatile little hydraulic press.

They like the way you can adjust it to the exact force you need for each job, all the way from 1 ton to 5 tons. The backstroke is adjustable, too, so the ram just clears the work on any job. Fast-acting controls. Prompt delivery from stock.

WRITE. Complete information and prices on the Hannifin line of 1- to 10-ton Hydraulic Presses will be sent on request.

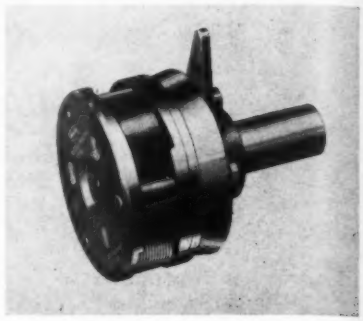
*Price complete with motor and starter F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.

HANNIFIN

Hannifin Corporation, 563 S. Wolf Road, Des Plaines, Illinois

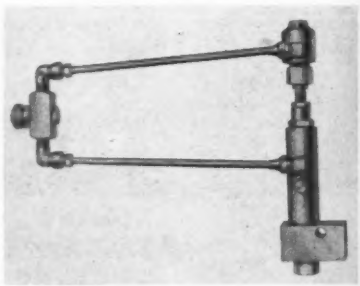
CIRCLE INFORM-A-GRAM KEY NO. 2142

A New Series of **FETTE** design self-opening thread rolling heads is now being offered by The National Acme Co., Cleveland 8. Series N heads can be used in either rotating or non-rotating holding spindles and



are adaptable to use on almost any type of lathe, automatic, threading machine, drill press, or similar equipment. The series includes 4 head sizes covering capacities from 1/16" to ¾". Shown is Style N-2. **Circle Inform-A-Gram No. A47.**

Automatically Apply A Pre-Measured Quantity of Mist Lubrication on open gears, chains, cams, rollers, eccentrics, slides and ways, circular saws, etc. with a new lubrication device. The MistOmatic Spray Control was designed for use with the power-operated, time-clock controlled cen-



tralized lubrication systems produced by Lincoln Engineering Co., Industrial Div'n, 5702-86 Natural Bridge Ave., St. Louis 20, Mo. **Circle Inform-A-Gram No. A48.**

Cutting Lengths Ranging from 22" Minimum to 102" Maximum can be handled by a double cutting machine. Model DM-352 is designed for cutting all non-ferrous metals with saw blades and ferrous metals with abrasive cut-off wheels. The machine has 2 semi-independent heads that cut simultaneously, either one of which can be positioned to make 90° cuts or will cut at any degree up to and including 45° in either direction. Either 12" or 14" blades can be used with the machine. Stone Machinery Co., Inc., Manlius, N. Y., or — **Circle No. A49.**

WALLS TU-WAY BELT SANDER

USE IT EITHER WAY

Full 1/3 h.p. G. E. Motor

VERTICAL

At last, a top quality industrial sander that provides all the most wanted features — yet sells for so little.

complete with cord, plug, switch ready to use

$89.95

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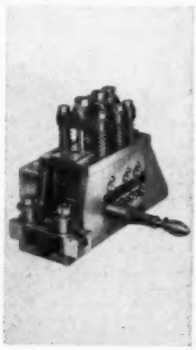
Plain and Motor Driven STRAIGHTENERS. Made in 18 models.

Manufacturers of Stock Reels, Roll Feeds, Straighteners, Scrap Choppers, Die Pullers, Foot Presses, Coil Cradles, Press Guards, Stock Oilers.



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Design Assistance Offered

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For small production runs on 1/8" to 1" stock. Exclusive screw design gives perfect knurl pattern. Furnished with 3 hardened knurls of standard 1/2" dia. Forged steel frame is self-centering. Write for illustrated folder.

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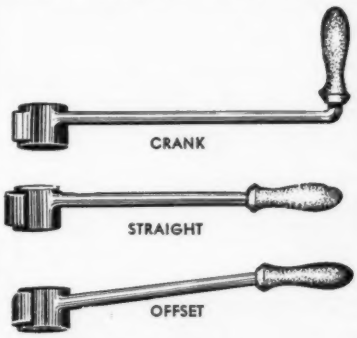
CIRCLE INFORM-A-GRAM KEY NO. 2154

REID TOOL ROOM *Accessories*

MALLEABLE MACHINE HANDLES



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THE REID LINE

Includes scores of other tool room needs such as plastic and steel ball handles, C.I. hand knobs, C.I. hand wheels, compression springs, balanced cranks, clamping levers, etc.

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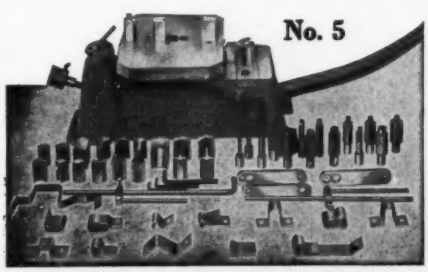

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Multiform

BENDER-CUTTER

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Available in hand or air operated models, the MULTIFORM is shipped complete with full assortment of dies and mandrels to form and cut round or flat stock up to 1/8"x1 1/2" as illustrated. Punching and round end blanking dies available. Other models up to 1/4"x4" air operated.

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SPRAY PAINTING MASKS
A competent engineering staff will counsel with you on the most efficient technique for handling your particular requirements.

PRODUCT DEVELOPMENTS BY C/M CONFORMING MATRIX

AUTOMATIC MACHINES
Increase production hundreds to one over hand methods. Reduce labor costs. Eliminate need of experienced workmen.

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Positive pressure and exact registration of the part in the mask. Reduce rejects. Free both hands for productive movements.

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50% faster than any other make. Cut solvent consumption. Avert production delays due to damaging of masks by hand scrubbing.

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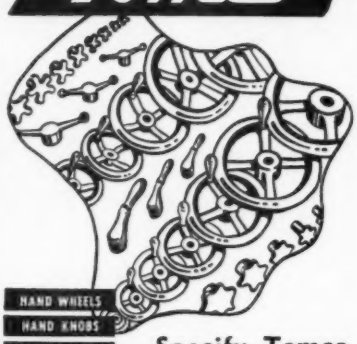
CIRCLE INFORM-A-GRAM KEY NO. 2161

Tomco



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HAND KNOBS
MACHINE HANDLES
HANDLES
BALL HANDLES
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A complete line of high grade hand knobs, handles, and hand wheels is available from Tomco. Immediate shipments are made from stock of standard items. Specialty items are made to your specifications.

For original equipment or replacement parts look to Tomco for quality and service.

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Stops Losses making Dies and Templates

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2303L North 11th St. • St. Louis 6, Mo.

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MAGNI-FOCUSER the 3-D Magnifier that speeds production and leaves both hands free to work

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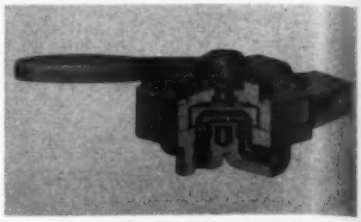
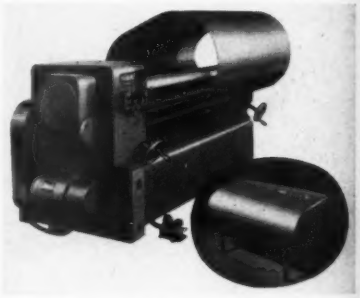
A Four-Way Air Valve incorporating the "Shear-Seal" principle, has been designed for the shop air range up to 250 psi. With low cost Model 2801, any port can be used as the



pressure port and the valve body can be rotated in 90° intervals for convenient piping. The valves are available in ¼" and ⅜" port sizes. Barksdale Valves, 5125 Alcoa Ave., Los Angeles 58, or — **Circle Inform-A-Gram No. A50.**

Developed for High Velocity Machining at light to moderate feeds is a new steel-cutting grade. Grade K7H, for all types of finishing operations, is especially suited for tracer or profiling applications. K7H is a hard carbide with exceptional hardness (93.5 Rockwell A) and unusual strength even at high temperatures. It is being produced only in button or throw-away type inserts by Kennametal Inc., Latrobe, Pa. **Circle Inform-A-Gram No. A51.**

Rapid Forming of Obround and Rectangular Shapes is possible with the modified models of Niagara slip roll forming machines. With this optional equipment, the machines alternately produce curved and flat surfaces. Only a simple layout on



the sheet, with markings where curves begin and end, is all that's needed as a guide. Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, or — **Circle No. A52.**

1850-Lb Drill Bit Pressure is possible with the Bux L-3 portable drill press. This drill press will hold fast to any steel surface 1" wide across the face of the magnet or larger. The rack and pinion drive eliminates alignment variation during the full 12" stroke. The Bux L-3 drill press will adapt to any standard portable drill. Buck Mfg. Co., 103 Roberts Rd., Los Gatos 1, Calif., or — **Circle Inform-A-Gram No. A53.**

Wardwell "50 F" Automatic Universal

Flute Grinder Sharpens

at very lowest cost

It sharpens and keeps in top condition Taps, Saws, Reamers, Woodruff Key Cutters, Milling Cutters. Saves and makes money for you every day. Grinds straight flutes, spiral points, and sharpens saws in gang.
Takes saws from ½" to 8" diameter, in gangs up to 3¾" long — automatically indexes. Takes reamers down to 1/16" diameter.
No special skill needed. Wardwell 50 F starts making money for you the very first day.
Please write for descriptive literature.

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Maker of Largest Line of Saw and Tool Sharpening Machines

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Why **SCHNORR Disc Springs?**

BECAUSE

1. Unlimited life within borders of permissible loads.
2. No creeping, initial settling or gradual fatigue.
3. Axial center pressure.
4. Exact adjustment to the desired pressure.
5. Small constructional height, large deflection.
6. Large inherent damping.
7. Large impact damping especially with multiple stacking.
8. Excellent space disposition.
9. Spring pressure, Spring length and Spring deflection can be easily determined for the same Spring size or can be changed by lengthening or shortening of the Spring columns or by multiple stacking. In special cases the character line can be made to divert from its usual straight form by diversified stacking.
10. Most spring sizes available from stock.

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NEISE MODERNTOOLS

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BY A QUICK, EASY, INEXPENSIVE METHOD
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JIG BORING
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Large Precision Machining
Done to your specifications
We Have
21 Jig Borers
KIDDE PRECISION TOOL CORPORATION
10 Locust Ave., Roseland, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 2174

CAMS ALL TYPES MADE TO YOUR SPECS

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President
EISLER ENGINEERING CO., INC.
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CIRCLE INFORM-A-GRAM KEY NO. 2175

HARDNESS TESTING
has been done with the SCLEROSCOPE
Since 1907
THE SHORE INSTRUMENT & MFG. CO., Inc.
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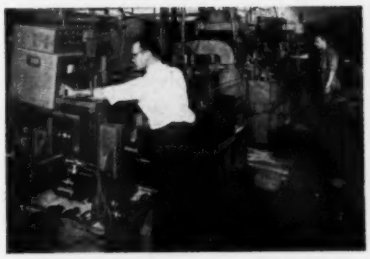
CIRCLE INFORM-A-GRAM KEY NO. 2176

Sperry
ultrasonic inspection news

Automatic Inspection and Control on Continuous Production Line



Continuous inspection of steel tubing and strip at production speeds is now an accomplished fact with the new Sperry Ultrasonic Reflectoscope and RA attachment. This unit scans material traveling at high speeds and registers the presence of both internal and surface defects. Far more thorough than the human eye, it provides for both defect recording and signaling in addition to continuous inspection. Designed to incorporate signal lights or alarm bells, as well as automatic marking and machine cut-off units, the Sperry Reflectoscope and RA attachment is a flexible, accurate instrument which opens a new area to more effective cost-cutting quality control.

sperry products INC.
Danbury, Connecticut

I would like to keep posted on latest developments in ultrasonic inspection by industry. Put me on the list to receive Sperry's new Ultrasonic Inspection Newsletter.

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CIRCLE INFORM-A-GRAM KEY NO. 2177

MAGNIFIER GUIDE BOOK

offered free to engineers, designers, inspectors and production executives

Packed in this 24-page manual entitled "INDUSTRIAL MAGNIFIERS — How to Choose and Use Them" are practical suggestions on selection, uses and available types of magnifiers. Book is offered FREE to aid you in solving those difficult problems involving testing, production, assembly, research, precision measuring and thousands of other industrial, process or laboratory operations.

In addition to describing available types of industrial magnifiers, this handbook covers prices, suggested applications and instruction on the care and use of magnifiers. Properly selected and used, they reduce rejects to a minimum, save money and speed production.

Also available on loan to responsible firms is a Magnifier Trial Kit containing over fifty different magnifiers to try out on actual jobs. There's no obligation. For full details on this offer and for a free magnifier guide book, write to **Bausch & Lomb Optical Co., 50405 Bausch St., Rochester, N. Y.** *Advt.*

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Anything . . . in THROW-AWAY INSERTS.

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Throw-Away Inserts, all Sizes and Types in any quantity · · Our Specialty

Send prints for quotations on Negative and Positive rake Inserts. Standard Inserts carried in stock for IMMEDIATE SHIPMENT.

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THE VIKING TOOL COMPANY, INC.

Cutting Tool Engineers and Manufacturers

100 NICHOLS ROAD SHELTON, CT.

CIRCLE INFORM-A-GRAM KEY NO. 2182

LIFTING DEVICES

for

FAST · SAFE · BETTER Material Handling of

· SHEETS
· COILS · BOXES
· MOLDS
· DRUMS · PALLETS
400 MODELS

Prompt Delivery
Write for full particulars

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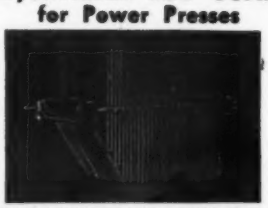
CIRCLE INFORM-A-GRAM KEY NO. 2183

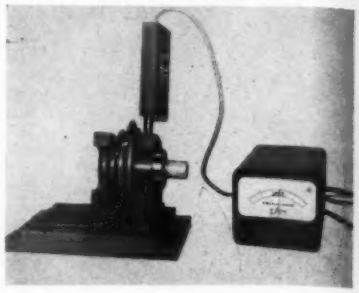
ADJUSTABLE ROD GUARD for Power Presses



HUMM SAFETY EQUIPMENT CO.
MFGR. OF COMPLETE LINE OF PRESS GUARDS
249 Sheffield Ave. ● BROOKLYN 7, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 2184

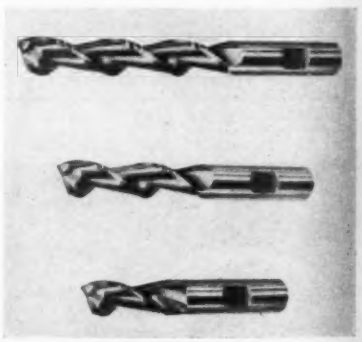
Check Up To 3500 Pcs/Hr at tolerances less than 0.0001" with the "Minitron" electronic micrometer. It is an all-purpose shop gage for the machine tool industry. The "Minitron" features 2 sets of adjustable receiving anvils which conform to the



workpiece. It is used for checking off balance or unwieldy pieces and provides positive time-cost reduction on all jobs. Industrial Gauges Corp., EAM Div'n, Englewood, N. J., or — **Circle Inform-A-Gram No. A54.**

"Diadem" Diamond Powder Compound is now packaged in a new "Bracon" squeeze-to-use tube of clear polyethylene plastic. The compound consists of selected diamond particles in a permanent viscous suspension. The variety of micron sizes available are identified by a color code and the corresponding color of the compound is matched by the tube cap. This compound is ideal for any grinding or lapping operation where diamond particles are a must. The compound is produced by United States Industrial Diamond Corp., 589 5th Ave., New York, and packaged in containers from Bradley Container Corp., Maynard, Mass., or — **Circle Inform-A-Gram No. A55.**

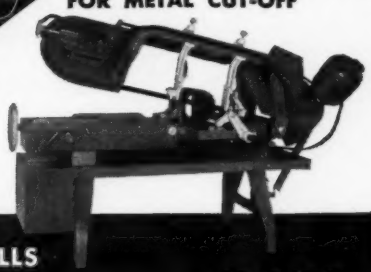
A Line of Standard End Mills has been designed for machining aluminum or aluminum alloys. These two-flute mills are available in a range



of diameters from ¼" to 2" in the 3 popular flute lengths. Putnam Tool Co., 2981 Charlevoix Ave., Detroit 7, or—**Circle Inform-A-Gram No. A56.**

Announcing

A NEW PRODUCTION TOOL FOR METAL CUT-OFF



THE WELLS MODEL 1000 HORIZONTAL METAL CUTTING BAND SAW

Here's the newest in the Wells quality line of metal cutting band saws—The Model 1000, a 10" capacity production machine powered by a ¾ H.P. motor. It offers the structural rigidity necessary for better cutting and operation and utilizes a 1" blade to further assure accuracy and efficiency.

The Model 1000 also features the exclusive Wells "constant load" blade tensioning device, four selective speeds, hydraulic frame check and optional wet cutting system.

See your Wells Distributor, or write for full details.

Wells

The Pioneers of Horizontal

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORP.

1948 CEDAR ST., THREE RIVERS, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 2191

100 TO 40,000 POUND COIL CAPACITY

LITTELL REELS

No. 25-18—Littell Motor Driven Automatic Centering Reel With Arm Control. Coil Capacity, 2,500 lbs.

Ask for a Littell Coil Weight Calculator

Whether you feed stock from 100 pound coils or 40,000 pound coils, there is a Littell Automatic Centering Reel to meet your needs . . . motor driven, electric brake and plain brake reels. Every Littell Reel is designed for swift, safe coil replacement and smooth, *controlled* uncoiling. All models combine smooth running accuracy with rugged construction that assures *extra* years of dependable service.

Write for Littell Reel Catalog Data

F. J. LITTELL MACHINE CO.

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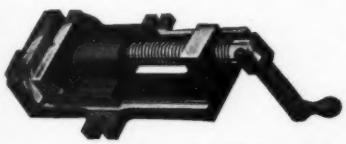

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with the NEW YOST DRILL PRESS VISE

- Developed expressly for use on drill press operations.
- Does away with special and costly jig fixtures.
- Available in two sizes:

No.	Jaw Width	Max. Opening
1D	3½"	4 "
2D	5 "	5½"

Write today for bulletin on the extensive Yost line.

YOST MFG. CO. 124 Grant St., Cambridge Springs, Pa.

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TAPPERS

New exclusive features and top quality make Lassy Tappers outstandingly the finest available, for the tool room—small lot production — and the problem jobs. A low priced investment that soon pays for itself.

Write for illustrated circular showing 3 models, and also Universal Tap and Die Guide.

LASSY TOOL CO.

Plainville, Conn.

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PRESSURELOK-224

the best diamond wheel ever developed for carbide tool grinding. Guaranteed ultimate cutting life from each diamond particle in every wheel.

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UNITED STATES DIAMOND WHEEL CO.

1833 ILLINOIS AVE. AURORA, ILL.

IMMEDIATE DELIVERY on all wheel sizes, STRAIGHT, DISH, CUP, FLARE and MOUNTED WHEELS; HONES.

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LEAD HAMMERS—Buy Cook "SHUR-GRIP"

They're a MUST in every shop where many blows have to be struck without marring surfaces. Available with "SHUR-GRIP" drop forged handles.

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LAWRENCE H. COOK, INC.

48 MASSASOIT AVENUE, EAST PROVIDENCE 14, R. I.

CIRCLE INFORM-A-GRAM KEY NO. 2196

IN 11 SIZES No. 6 to 1" N C In all S. A. E. sizes.

You Need an Extra Hand Now to Speed Up Production!

HEIMANN TRANSFER SCREW SETS

Here is the *faster*, more precise way of transferring open and blind screw holes—make savings in "wage-dollars-per hour" of your expensive hands on every job. A die-and-tool maker's tool with many other applications for die makers and machinists. A set of 6 Hardened Screws nested in combination holder and wrench —no other tools needed. Get more work now—save money too!

HEIMANN MFG. CO. • URBANA, OHIO

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10,000 lbs. pressure with CADDY® MODEL P-5

SPECIFY CADDY® TOGGLE CLAMPS FOR

LONGER LIFE
MORE PRESSURE
FASTER ACTION

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IF

You Want To Cut Production Costs . . .

THEN

WITHOUT MACHINING, You Can:

Anchor Bushings in Drill Jigs
Secure Magnets in Fixtures
Anchor Shafts in Alnico Rotors
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Simple Procedures Described in Bulletin A1, Write for it TODAY.

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CERRO DE PASCO CORPORATION
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INSERTED BLADE GENESEE FACING AND COUNTERBORING TOOLS

Interchangeable Pilots

Constant Chip Space Throughout Life of Blades

Standard Sizes 1¼ to 4 Standard with Straight or Morse Taper Shanks

H. S. S.—Carbide Tipped Blades. Save 25% or more over cost of Solid Tools

Consult our Engineering Department on your Inserted Blade Production Tool Problems.
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566 HOLLENBECK ST. • ROCHESTER 21, N. Y.
Adjustable Hollow Mills • Facing and Counterboring Tools • Special Production Tools • Since 1903

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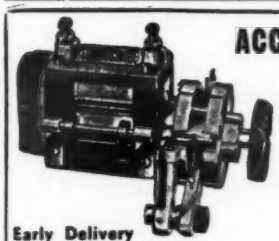

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Models to fit:
ANY PRESS
FOR ANY JOB
FOR STOCK UP TO 12" WIDE

Early Delivery on Standard Models

"RFC" ROLL FEEDS are quality built for long, dependable service.

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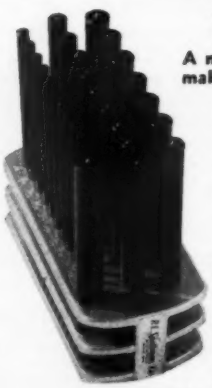


SPELLMACO SPOTTERS

A matched set of transfer punches for toolmakers, machinists and tool cribs.

Used for transferring location of threaded, drilled and reamed holes, slugs, blanks, etc.

Precision made of finest tool steel carefully heat treated and tempered for long life. .0025 undersize to facilitate use—black oxide finish.

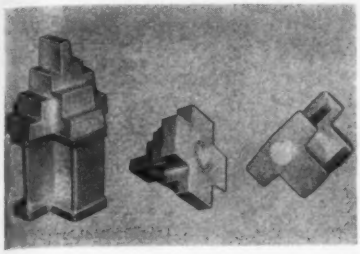
Set No. 3-17: 28 punches with indexed stand—Sizes 3/32" to ½" by 1/64" plus handy 17/32" size—length 4⅞". PRICE only $16.80

Single size available.

R. L. SPELLMAN CO. • Urbana, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 2205

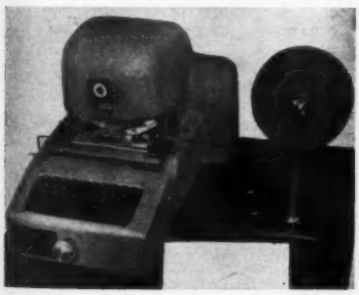
Protect Fine Machine Table Surfaces and save machine setup time by using new Multi-Step setup blocks made of aluminum alloy. These blocks will absorb metal chips, and even if dropped, will absorb the nicks and scratches without injury



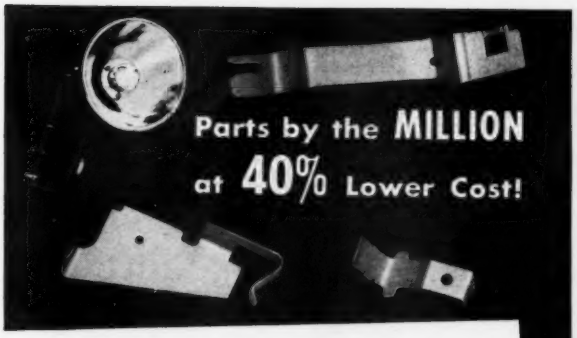
to machine tables. Used for setup on jig borers, boring mills, drill presses, milling machines, planers, etc., the setup blocks hold work from 0 to 3" and will withstand great weight under clamping pressures. Jergens Tool Specialty Co., 712 E. 163rd St., Cleveland 10, or — **Circle Inform-A-Gram No. A57.**

Move Heavy Machinery or Equipment with Mighty Mover dollies — a set of four makes moves in hours instead of days. One man can quickly, easily, and safely move heavy machinery by jacking up the machine, bolting on the dollies, and moving with pry bar to desired location. Mighty Movers cut make-ready time 75%, work easily on rough floors, and have fully-controlled movements. They are 9" long, 5" wide and high, and weigh 40 lbs. Mighty Mover Co., 1482 S. Milwaukee St., Denver 10, or — **Circle Inform-A-Gram No. A58.**

Mark Embossed Strip Tags with a new Automark electric strip tag typewriter that not only marks the tag but cuts it off to the desired length and punches holes in each



end of the tag. Model EMT-ST Automark will emboss any size character from 1/16" up to ¼" in size. A stand for holding a coil of strip stock is standard equipment. Defiance Machine & Tool Co., 1920 S. Vandeventer Ave., St. Louis 10, Mo., or — **Circle Inform-A-Gram No. A59.**



The parts you see here were formerly turned out on power presses . . . took two or three operations. Unit cost was far too high, so this prominent maker of cameras called on A. K. Tool Company.*

Result? Our Multi-Slide machines have turned out more than a half-million of each of these flashgun parts . . . at a 40% saving in cost and with gage-like accuracy.

You too can save with A. K. Tool if you fabricate small metal parts requiring piercing, blanking, forming, swaging or embossing. Tell us what you make, or send us your product literature or blueprints. We'll give your problem prompt and careful study.

*name on request

A. K. TOOL COMPANY
U. S. ROUTE 22, MOUNTAINSIDE 30, N. J.
Telephone: WEstfield 2-7300

CIRCLE INFORM-A-GRAM KEY NO. 2211

makes possible savings as much as 25 to 50%

This latest Setko Set Screw is for applications in which slabbed portion cannot extend beyond tapped hole. To permit flush insertion this screw is made with an undersized slab. You can set it to the same holding power as an equivalent size socket screw, with savings in cost ranging up to 25 and even 50%! Tamper-proof; resists accidental removal; special wrench for use when removal is desirable.

Fill in and mail coupon at the right for further data on this and other special Set Screws.

Set Screw & Mfg. Co.
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We Specialize in Solving Puzzling Set Screw Problems

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Without cost or obligation please send me data on
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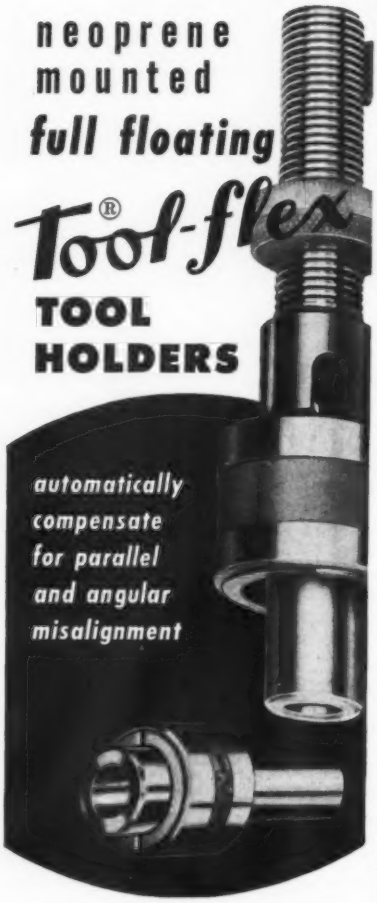
CIRCLE INFORM-A-GRAM KEY NO. 2212

neoprene mounted full floating Tool-flex® TOOL HOLDERS



The oil, heat and wear resistant Neoprene insert, found only in "Tool-flex", provides a universal float that corrects for both parallel and angular misalignment. This assures quick set-ups and minimizes scrap due to bell mouthed and oversized holes or torn and oversized threads. By floating reamers, taps, etc., in a cushion of Neoprene, tool life is increased. Available in a range of sizes and models to suit any requirements, including close centers and Acme threaded shank for multiple spindle set-ups. "Tool-flex" holders are fully guaranteed.

Write Dept. TP-5 for information

BURG TOOL
MANUFACTURING COMPANY, INC.
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GARDENA, CALIFORNIA

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SCHERR MAGNI-RAY

IT MAGNIFIES
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WHATEVER YOU WANT TO SEE
appears under the Magni-Ray enlarged in every detail, in true perspective, and drenched, flooded with light so intense, so revealing that it is in itself practically as effective as another degree of magnification. The subject of your inspection can have no secrets from the Magni-Ray.

OBLIQUE RAYS MAKE SCRATCHES & DEFECTS STAND OUT CLEARLY — GENUINE OPTICAL GLASS LENSES

HEAVY ADJUSTABLE BASE REMOVABLE LENS HOUSING FOR INSPECTION OF LARGE SURFACES, ENGINES, ETC.

3 MODELS AVAILABLE PRICED $23.50 TO $35.00
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COMPLETE LINE OF PRECISION INSTRUMENTS

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FREE

CUTTING OIL CHART

Contains money-saving data on:

1 - WHICH CUTTING OIL TO USE for:-

Turning	Boring	Milling
Reaming	Broaching	Sawing
Hobbing	Drilling	Tapping

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"My firm saves $27,000 annually with specially designed ESSEX carbide burrs."

"Before we switched to ESSEX tools, we spent $45,000 yearly for high speed burrs. ESSEX carbide burrs, made to our specific needs, cost us only $18,000 — an annual saving of $27,000!"

Find out how ESSEX carbide tools can help *you*. Write for *free*, 12-page illustrated catalog today.

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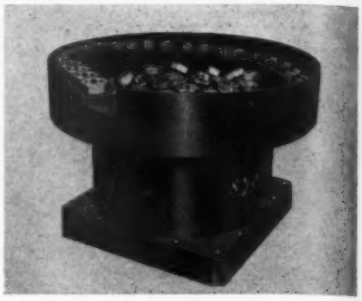
My name.....
Company.....
Address.....
City..... Zone..... State.....

CIRCLE INFORM-A-GRAM KEY NO. 2224

Orient and Feed Parts up to 8" long in either a clockwise or counter-clockwise direction with this vibratory parts feeder. Model EB-3-B can be equipped with single or dual discharge to gravity feed tracks for

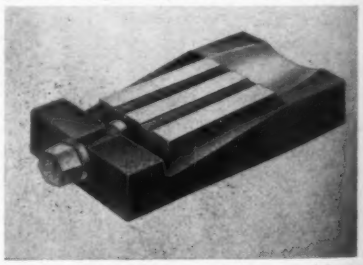


automatically feeding parts to processing, packaging, and assembly line equipment. It has a 36" dia bowl. Syntron Co., 341 Lexington Ave., Homer City, Pa., or — **Circle Inform-A-Gram No. A60.**

Adapted to Valve Guide Hole Drilling and other work where hole size, roundness, and straightness must be held to strict specifications, is a new tube-reamer-type gun drill. The drill is useful in automotive and aircraft engine drilling. It is an

end cutting tool with a single cutting edge. A micro finish of from 20 to 100 is possible, depending on requirements. Eldorado Tool and Mfg. Co., 342 Boston Post Rd., Milford, Conn., or — **Circle No. A61.**

A Lifting Capacity Exceeding 3000 Lbs is a feature of a new leveling jack. Empco Style JD-O jack is for



use with medium weight machines and production and toolroom equipment of 11 types. Its design incorporates features of self-alignment to compensate for uneven floor surfaces up to 5°. Enterprise Machine Parts Corp., 2731 Jerome, Detroit 12, or — **Circle Inform-A-Gram No. A62.**

Production UP at NORTHROP

KNU-VISE clamps help cut drilling time

MODEL HS-400

Wherever fast, positive material holding is required—Knu-Vise toggle-action clamps are helping manufacturers do a better job.

One application is shown above. This time Knu-Vise clamps are in use on a special fixture developed by Northrop Aircraft engineers for simultaneous drilling of seven rocket pod orifice holes for the Northrop F-89 Scorpion. Drilling time has been reduced from 10 hours to 45 minutes—including set-up time.

REMEMBER—if you have a holding problem—Lapeer Mfg. Co. offers a wide range of hand, air and oil operated clamps to increase efficiency and lower costs. Our catalog contains complete information. Write for your copy today.

Manufacturers of over 150 models of manually and air-operated clamps and pliers

KNU-VISE PRODUCTS LAPEER MANUFACTURING CO.

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WESTERN DIVISION 422 Magnolia, Glendale, California • CANADIAN DIVISION Higginson Engr., Hamilton, Ontario

CIRCLE INFORM-A-GRAM KEY NO. 2231

Expanding Mandrels

Accuracy 001" - No Distortion

No Slipping - Everlasting

K.O.LEE CO.

ABERDEEN, SOUTH DAKOTA

If it's made by Lee *it's a* "Knock-Out"

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FREE! WRITE FOR THIS VALUABLE GAGE BLOCK AND SPECIAL GAGE MANUAL

GIVES DETAILS ON CARE, MAINTENANCE, AND INSPECTION

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JANSSON GAGE COMPANY

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13548 AUBURN AVENUE—DETROIT 23, MICHIGAN

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YESTERDAY'S PIONEER . . . TODAY'S LEADER

WELDON

Stub Length Double-End End Mills

NEW!—Stock Items

A new line of small double-end end mills, with flutes shorter than regular, offer these advantages:

GREATER STRENGTH
LONGER TOOL LIFE
FAR LESS BREAKAGE
FASTER FEEDS

Same high Weldon quality in 2- and 4-flute styles.

For complete list send for Folder No. STM-1

THE WELDON TOOL CO. Cleveland 4, Ohio

3000 WOODHILL ROAD

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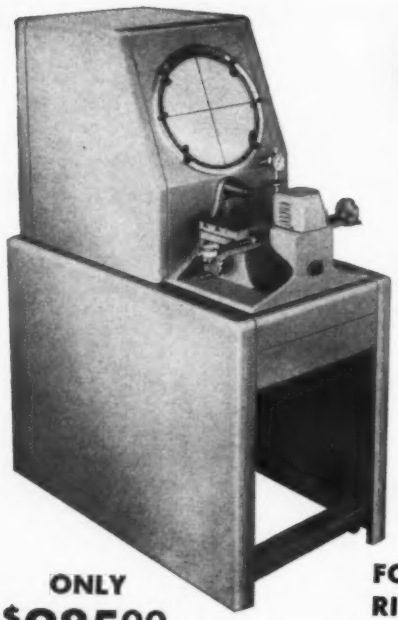

OVEL Optical COMPARATOR

New, low-priced contour projector for quick, economical precision inspection

FOR ACCURATE CHECKING RIGHT IN THE SHOP

ONLY $985.00

Large work capacity, sturdy, precision construction and optic arrangement which permits use in bright light in the shop. Ideal for shops using mechanical measuring methods because they haven't been able to afford the luxury of an optical comparator.

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OVEL MANUFACTURING COMPANY
BENTON HARBOR, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 2241

STEP RIGHT UP FOLKS FOR A FREE HELPING OF STINGING CHIPS...
GET 'EM WHILE THEY'RE GOOD 'N' HOT!!
ENOUGH OF THAT! THE BOSS WANTS YOU TO USE THIS DILLEY MAGNETIC GRIP SHIELD!!
HERE! SLAP IT ONTO YOUR MACHINE AND YOU'LL SAVE EVERYBODY FROM CUTS AND BURNS!
NEXT DAY...
JOE'S PRODUCTION HAS DOUBLED AN' EVERYBODY'S SAFE AN' HAPPY!!
FINE! I WANT "DILLEYS" ON EVERY MACHINE IN THE PLACE!

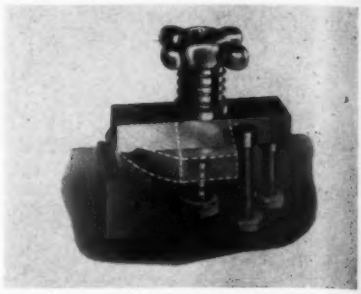
Why don't You get HAPPY?

Write us today for descriptive folder with prices.

The Dilley Mfg. Co., 1633 Ansel Rd., Cleveland 6, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 2242

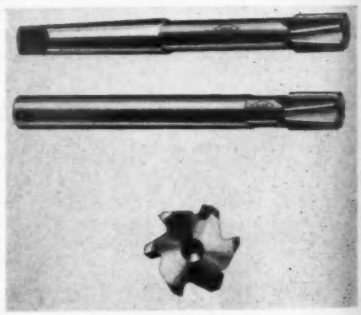
Operate This Fixture Clamp with One Hand, leaving the other one free for handling workpieces. The Swing-lock clamp operates in any position without the strap falling out of place even in unclamped position. It will operate in restricted areas not suited



for a forward and backward clamping operation. The clamp is made in a range of sizes from ¼" through ¾" studs and a midget size with a 3/16" stud. West Point Mfg. Co., 26935 W. Seven Mile Rd., Detroit 19, or — **Circle Inform-A-Gram No. A63.**

Nickel Base Alloy Powders for hardfacing have been developed by Western Carbide Corp., subsidiary of Superweld Corp., 6840 Vineland, North Hollywood, Calif. They can be sprayed from various types of guns and applied to practically all metals with melting points about 1850°F. Hi-C spray powders provide a hard deposit with excellent resistance to wear, corrosion, and oxidation at high temperatures insuring longer life for parts.
Circle Inform-A-Gram No. A64.

Alternate Right and Left Hand Spiral Cutting Edges are featured on a special type reamer designed for high production operations. The double spiral design of the "Altercut" chucking reamer prevents chattering and helps relieve strains imposed upon the reamer. The reamer



is available in high speed steel and carbide, in straight and taper shank in sizes ranging from ¼" to 1½" dia. Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich., or — **Circle Inform-A-Gram No. A65.**

Save on small grinding jobs with Moore Motorized Centers

All ground in one set-up. These parts illustrate wide variety of Motorized Centers' work. Small punch in top row has a rectangular end 1/32" x 3/32", ground central with body.

New toolroom attachment for surface grinders, jig borers, drill presses, millers, etc., handles flat, curved or circular work in one setting.

You'll wonder how you ever got along without this portable, precision-built grinding accessory. No longer is it necessary to tie up large, expensive machines to grind square and round punches...do taper grinding, index grinding and faceplate work.

Motorized Centers can be set on a surface grinder chuck in a jiffy and the job completed quicker than the grinding wheel on a large machine can be changed. Think of the resulting savings in costly toolroom labor and materials.

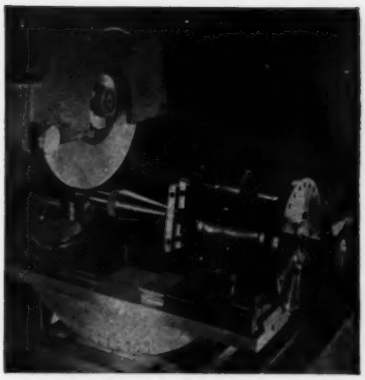
With it, in one setting, you can now grind flat, curved or circular work—in any combination of taper or contour—all within .0005". The index plate allows indexing in the same operation, too. Tapers can be reversed or changed by loosening two screws in the rocking bed, and the index plate can be engaged by merely pressing a plunger. The simple tail-stock center readily permits the use of specials—male, female or cutaway.

CATALOG WITH 20 ACTION PHOTOGRAPHS will show you graphically how you can use this versatile tool for production and inspection, too. In it are examples of some of the many difficult toolroom jobs you can handle easily: double tapers, equally spaced slots, small cylindrically tapered punches and many others. It's yours for the asking.

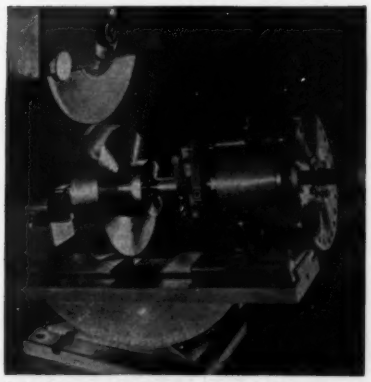
SPECIFICATIONS

Length—overall	12"
Width—including motor	10"
Height—overall	8"
Distance between centers—maximum	6"
Centers will swing	6"
Maximum grinding angle (using 10° angle block)	30°
Motor	1/25 H.P., 115 volt, 60 cycle

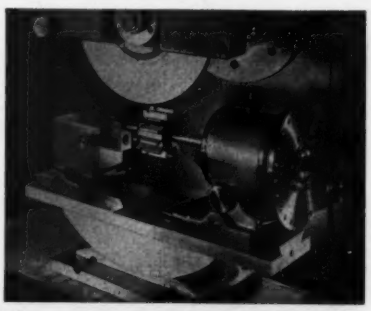
MOORE SPECIAL TOOL COMPANY, INC.
726 Union Avenue, Bridgeport 7, Conn.



Double tapers and hex shoulder ground with a single set-up. Rocking bed is equipped with a tangential screw for fine-setting taper angles.



Grinding a 10° taper on a machine part 5" long, 5" in diameter on centers.



12 equally spaced slots in punch holder ground by using index plate.

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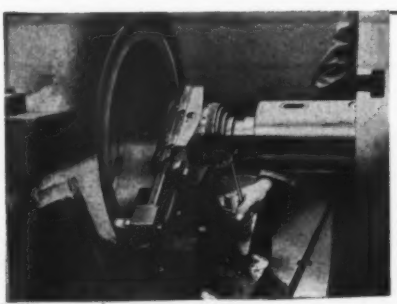

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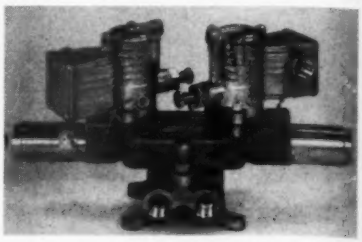

mechanical centering of the main valve stem in neutral position without the use of mechanical springs. Valvair Corp., 454 Morgan Ave., Akron 11, or — **Circle No. A66.**

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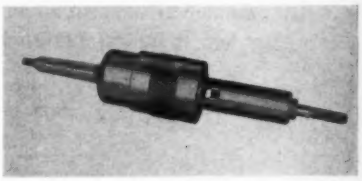

increased production. The drivers can be used on any machine with a reversible spindle except transfer machines, drilling heads, and automatics with lead screws which require special drivers with compensating springs. Scully-Jones and Co., 1901 S. Rockwell St., Chicago 8, or — **Circle No. A68.**

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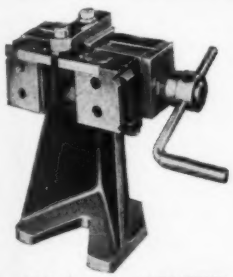

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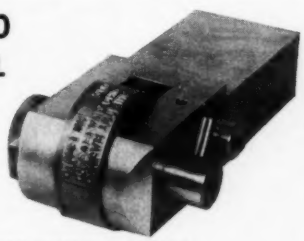

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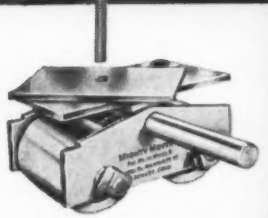

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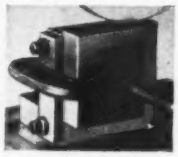
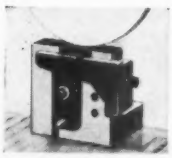
LASSY MASTER V-BLOCK ANGLE PLATES

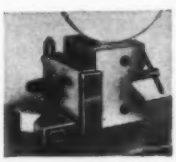
This Master V-Block Angle Plate is an improved new design. Saves hours of setup time. Assures precise work accuracy. Requires less skill.



Side Gage automatically squares work precisely and without removing angle plate from chuck. Repetitive accuracy maintained.



Adjustable parallel holds the smallest work for position and clamping with ease and accuracy.



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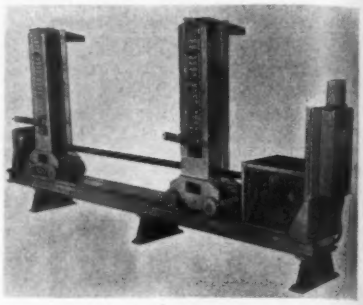
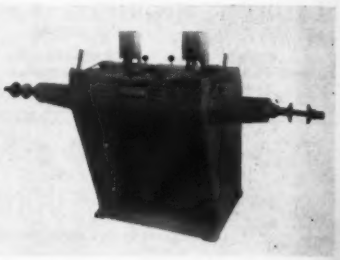
This Bar Unloader unloads pieces of bar or tubing from a production machine to a high tote box. The unloader has one stationary tower and

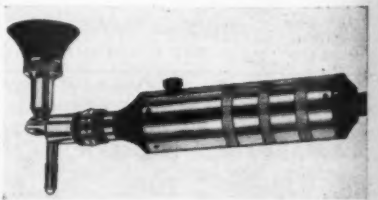


a movable elevator so that it can be adjusted to handle pieces from 3' to 12' long and from 1½" to 3" dia, at a variable rate of speed. Feedall, Inc., Willoughby, O., or — **Circle Inform-A-Gram No. A70.**

A Wider Swing is featured on a two-spindle, variable speed buffing and polishing lathe. Model VRROW has a swing of 20" from side of base to face of inner flange, instead of the usual 12" swing. The two spindles



operate independently. Spindle speeds can be changed instantly while the lathe is running by turning the dials. Hammond Machinery Builders, Inc., Dept. 1631, Kalamazoo, Mich., or — **Circle No. A71.**



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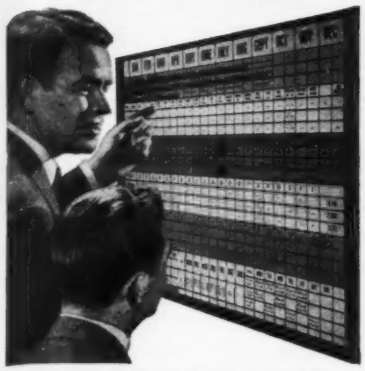

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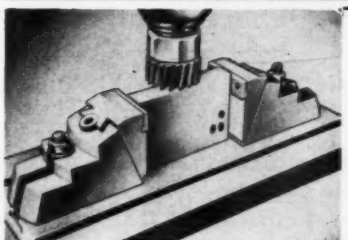

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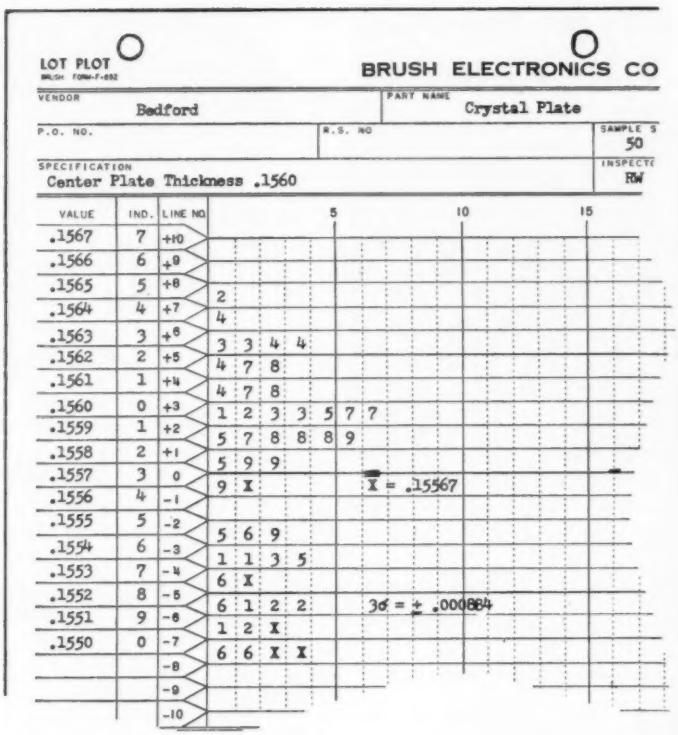
LOT PLOT

BRUSH ELECTRONICS CO

VENDOR: Bedford

PART NAME: Crystal Plate

P.O. NO.

R.S. NO

SAMPLE S: 50

SPECIFICATION: Center Plate Thickness .1560

INSPECTI: RW

VALUE	IND.	LINE NO.	5	10	15
.1567	7	+10			
.1566	6	+9			
.1565	5	+8	2		
.1564	4	+7	4		
.1563	3	+6	3 3 4 4		
.1562	2	+5	4 7 8		
.1561	1	+4	4 7 8		
.1560	0	+3	1 2 3 3 5 7 7		
.1559	1	+2	5 7 8 8 8 9		
.1558	2	+1	5 9 9		
.1557	3	0	9 X	$\bar{X}$ = .15567	
.1556	4	-1			
.1555	5	-2	5 6 9		
.1554	6	-3	1 1 3 5		
.1553	7	-4	6 X		
.1552	8	-5	6 1 2 2	$3\sigma = \pm$ .000884	
.1551	9	-6	1 2 X		
.1550	0	-7	6 6 X X		
		-8			
		-9			
		-10			

Fig. 4. A 4-sigma spread would indicate that the machine is capable of accepting a tolerance of ± .001" or greater. When the b/p tolerance is appreciably greater than ± .001", routine inspection is not required as long as the setup is carefully checked, and the machine rechecked periodically for drift and wear.

. . . Machine Capability from page 112

spindles, Figure 3, milling the thickness dimension of small blocks of water soluble piezoelectric crystals used in electro-acoustic equipment.

These piezoelectric crystals are grown in large bars. Slabs and rough plates are sawed from the bars. Final plates are rectangular and roughly the size of gage blocks. They must be machined square, flat and parallel with tolerances of about .001". Surface finish must be better than 50 micro-inches. It has been found possible to meet these requirements by machining at very high speeds with special Tantung milling cutters. The crystals are held in a vacuum chuck on a rotating table. They are given a rough and finish cut on one side, turned over, and rough and finish milled on the other side.

There is evidently some warping or "flip flop" in the table, but it should be noted that the total variation is only .0016".

Now, how do we get at the capability of the machine? Probably the easiest way is by a Lot Plot[1]. The one shown, Figure 4, indicates 3-sigma limits of .000884".

Our 4-sigma spread (4/3 of 3-sigma) would be .00118" indicating that the machine is capable of accepting a tolerance on this operation of ±.001" or greater. When the tolerance is much greater than ±.001", routine inspection is not required as long as the setup is carefully checked and the machine rechecked periodically for drift and wear.

What happens if the machine is not capable? The job cannot be economically run and all our friends will be frustrated. What to do? Is there a better machine available? If so, can we use it? If not, armed with our facts, let's go to the engineer and ask him to prove to us that the blueprint tolerance is really needed. If it is, our only alternatives are a change in design of the workpiece, or another source of supply.

Perhaps as important as the uses of machine capability described above, is its use to determine need for repair. Usually after some breaking-in period, a machine tool gives its best performance. Its performance, then, slowly worsens with wear throughout its life. Often, supervision is aware of when a tool has worn to the point where rebuilding is desirable. This is not always so, since the wear is so slow. In any event, facts may be required to persuade management to authorize rebuilding. By doing machine capability studies at regular intervals, perhaps monthly, the true condition of the tool is easily established.

Don't get frustrated. Don't let people put jobs on machines which are not capable of handling them. 4-sigma or fight! ΩΩ

(1) "Quality Control Handbook," by J. M. Juran, page 682. Published by McGraw-Hill Book Company.

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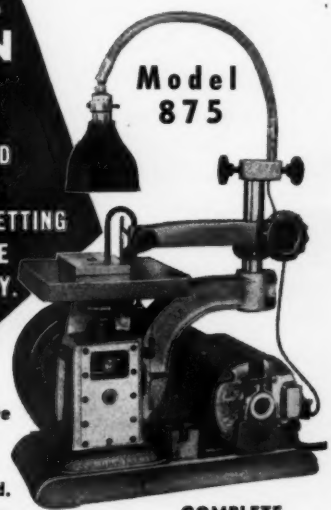

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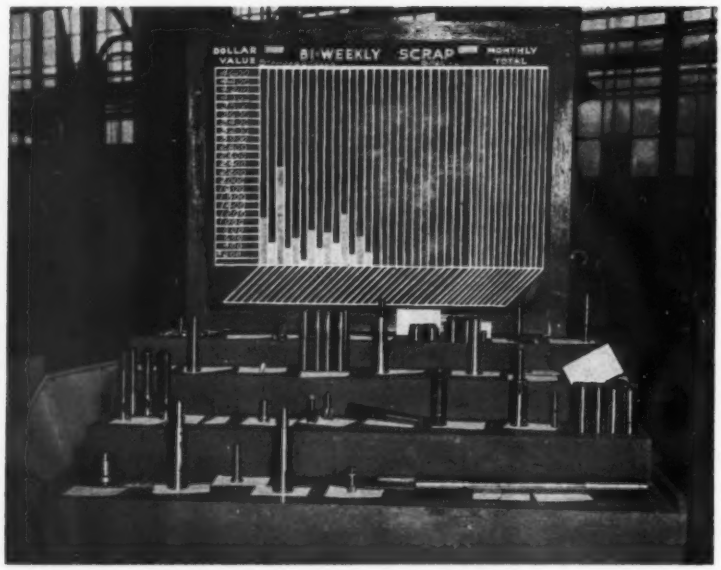

Fig. 2. A display of scrap is a powerful Q-C tool. The value of the various items, which cannot be sold, is given in terms of nearness to completion. The display is changed periodically. No identification is made of personnel involved — just the dollar losses.

. . . Job Lot Production from page 118

and engine lathe, are covered by a floor inspector. All departments have a "first piece" inspection which is made by the foreman. Once the "okay" is given, the inspector makes regular spot checks as to in-process manufacture and each operational inspection is recorded on a standard shop form as to conformity to specifications. Deviations are immediately called to the department supervisor's attention and corrective measures are taken.

The automatic screw machine department was the first in which Statistical Quality Control was instituted and in which four stations were set up.

Our universal milling department is covered by an installation at the production mill section because, here again, we have a very high proportion of short-run jobs. The drill press and broaching departments have a two-station installation, and a centerless grinder that feeds both the milling and drill press departments is also included in the quality control setup. Our last permanent installation is located at a Gardner face grinder that supplies collars for a subsequent lapping operation.

Of course, at any specified time, we are in a position to apply our quality control tool to wherever the conditions warrant. The panel of one of our stations is shown in Figure 1. From our experience, we find that we enjoy these specific benefits as a result of our quality control program:

1. An over-all reduction in cost of inspection.

2. Disclosure of where and when 100% inspection is needed.

3. A reduction in both scrap and rework time from an initial 3% to the present 1% on jobs covered by statistical inspection.

4. We are able to pin-point operational problems involving tooling, methods, and equipment.

5. Customer relations are greatly aided in that they benefit from the improved uniformity in our product quality.

Figure 2 shows one of our most effective quality control tools — a tiered scrap display bench. It is located adjacent to our main shop aisle in close proximity to our time clock racks, so that it is in full view of all employees leaving and entering the plant. Each reject or group of rejects is identified as to the reason why and the approximate cost of the item in proportion to its degree of completion, and is displayed for several days. No attempt is made to identify any individual responsible for the scrap on display. After each display, an interval of three days is used before the next showing takes place.

It has been noted that great interest in reviewing rejects has been attained by using this kind of approach. It is the feeling within our company that every employee wants to do a good job, and that all that needs to be done is to bring poor workmanship out into the open to serve as a reminder that today's quality is tomorrow's reputation! ΩΩ

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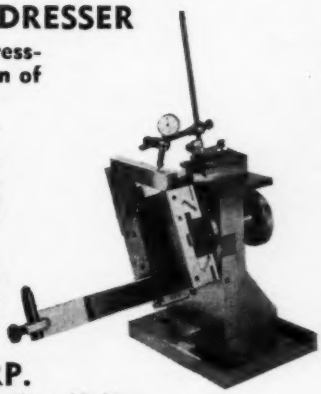

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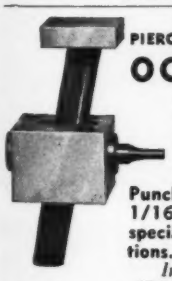

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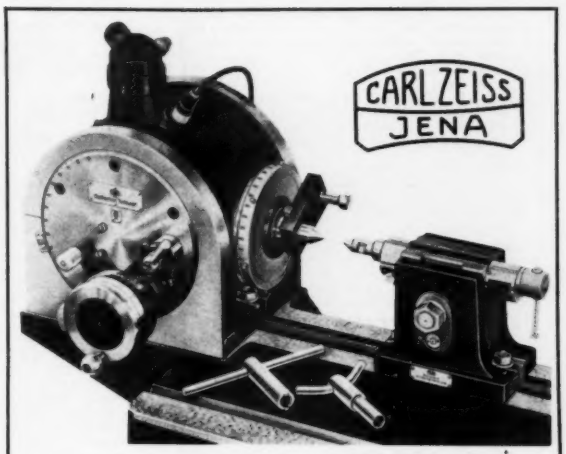

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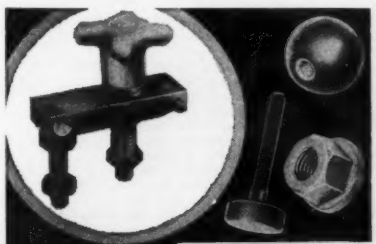

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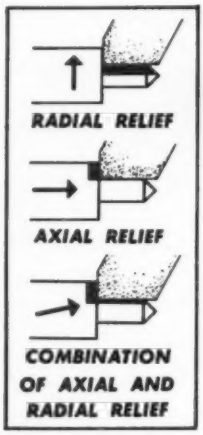

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